COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENERGY RESOURCES

# ENERGY MANAGEMENT SERVICES GUIDE V. 2.1:

## *PROVIDING ENERGY SAVINGS THROUGH ENERGY PERFORMANCE CONTRACTING*


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## TABLE

LIST OF ABBREVIATIONS

| | |
|---|---|
| DOER | Massachusetts Department of Energy Resources |
| DHCD | Massachusetts Department of Housing and Community Development |
| DCAM | Massachusetts Division of Capital Asset Management |
| ECM | Energy Conservation Measure |
| EMS | Energy Management Services (A specific type of Energy Performance Contract under Massachusetts's law) |
| EMSC | Energy Management Services Contract |
| ESCO | Energy Services Company |
| FEMP | Federal Energy Management Program |
| IEQ/IAQ | Indoor Environmental Quality/Indoor Air Quality |
| IPMVP | International Performance Measurement & Verification Protocol |
| NPV | Net Present Value |
| RFR | Request for Response (Request for Performance) |
| RFQ | Request for Qualification |

**Acknowledgement**

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This document is for informational purposes only. The information contained within is general and subject to change. It is intended to serve as an introduction to elements pertaining to energy management services (energy performance contracting) and should not be used as a substitute for a thorough analysis of facts and the law. The document is not intended to provide legal or technical advice.

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## INTRODUCTION

The Massachusetts Department of Energy Resources prepared this document to help municipalities and school departments understand how to improve the energy efficiency of public buildings through **Energy Management Services** (EMS). This document provides a guideline for implementing an EMS project**.**

In Massachusetts, state and local governmental agencies may use this alternative procurement method to contract with an Energy Services Company (ESCO) for the provision of Energy Management Services if the primary purpose for doing so is to reduce energy and/or water consumption. Under M.G.L. c.25A §11C (RFR) or §11I (RFQ), Public Agencies seeking to improve the energy efficiency of a facility may contract with an ESCO to design, purchase, install, operate and maintain its energy systems. **Maximum contracts terms are twenty years for both RFP and RFQ process.**

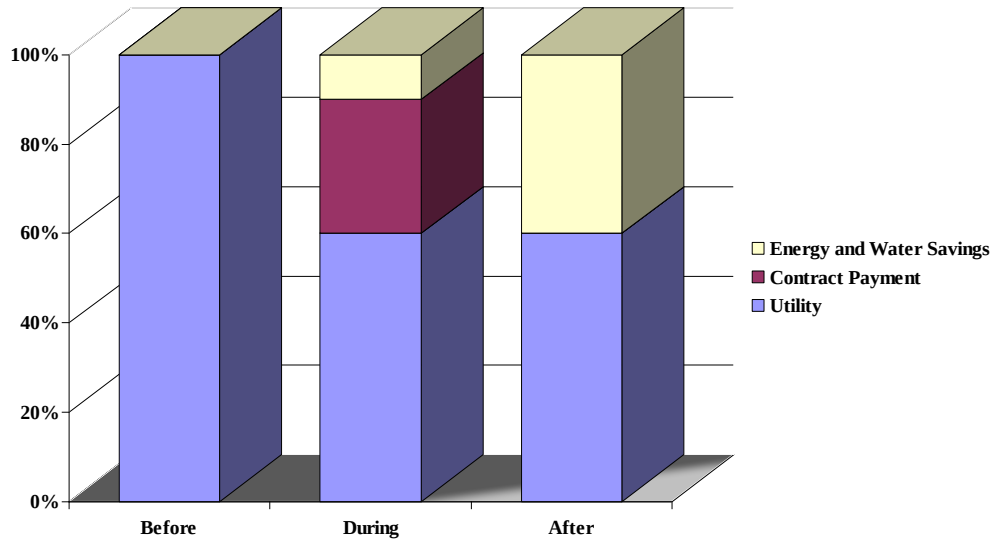
M.G.L. c.25A §11C and 11I authorizes procurement for energy, water, and utility conservation services, onsite energy generation, and cogeneration, known as energy management services, with three significant differences from other state procurements (under M.G.L. c.30B and M.G.L. c.149):

1. ***First*, it allows a design-build process that provides continuity in the conceptualization, engineering & design, construction, and monitoring of the project.**

2. ***Second, once a contract is awarded it allows the project to proceed from design to closeout without further public bidding.***

3. ***Third*, the project is paid for by energy savings that are guaranteed by the ESCO; in other words, an ESCO makes capital improvements to the premises and, in return, receives a payment from the cost savings attributed to the ESCO's performance on energy expenditures. The following chart illustrates costs and savings to a facility under an Energy Management Services arrangement.**

**Figure 1: Cost Savings over the Term of a Project**



Public Agencies may purchase a variety of building equipment and services under an EMS Contract. Commonly implemented improvements include energy efficient lighting, air-conditioning systems, energy management control systems, motor replacements, and variable-speed drives for pumps and fans. Generally, an ESCO includes any improvement expected to recover its own cost in energy savings over the term of the agreement. This means that longer payback items, such as adding ceiling insulation or replacing windows, may not qualify unless they are bundled[1] with quick payback items such as energy efficient lighting.

In addition to equipment installation, the ESCO may propose various repair and maintenance services. Often ESCOs propose repairs to existing systems, such as re-installation of damaged or missing controls or repairs of leaks in chilled water piping, etc. The ESCO may assume responsibility for preventive maintenance and repairs to all new equipment installed, offer to take responsibility for maintenance, or even operation of existing equipment. For example, the ESCO may offer to provide remote monitoring and adjustment of temperature setpoints with a computerized temperature control system.[2]

In Massachusetts, three agencies oversee Energy Management Services: 1) the Department of Housing and Community Development (DHCD) presides over Housing Authorities, 2) the Division of Capital Asset Management (DCAM) presides over state government buildings, and 3) the Department of Energy Resources (DOER) presides over other public buildings (cities, towns, counties, quasi-public agencies, and schools). Each agency provides similar model documents.

Contact information for Energy Management Services at cities, towns, counties, quasi-public agencies, and public schools:

| | |
|---|---|
| Department: | Department of Energy Resources |
| Mailing Address: | 100 Cambridge Street, Suite 1020, Boston, MA 02114 |
| Contact: | Eileen McHugh |
| Phone: | 617-626-7305 |
| Fax: | 617-727-0030 |
| Email: | www.doer.energy@state.ma.us |

Please refer to Appendix A for a list of references to documents, guides, and tools. Most, if not all, are available on-line.

[1] See glossary
[2] Guide to Energy Performance Contracting, July 1998, Hawaii Department of Business, Economic Development, & Tourism: Energy, Resources, & Technology Division

## I: FUNDAMENTAL CONCEPTS OF ENERGY MANAGEMENT SERVICES

EMS is an arrangement structured so that the cost of implementing the Energy Conservation Measures (ECM)[3] is recovered from savings created by the performance of those measures. Equipment purchased and installed using EMS may include any equipment or system upgrade designed to conserve energy or water. This includes improvements to existing equipment. ***What distinguishes these contracts is the provision of a performance guarantee on energy savings from the installed retrofit measures***. This type of contract usually offers a scope of associated design, installation, and maintenance services. The contract period can range from 10 years up to 20 years and usually requires a certain minimum level of capital investment for the project before a contract is considered.

Under an EMS contract, the ESCO provides a service package that typically includes the design, engineering, financing, installation, and maintenance of retrofit measures to improve energy efficiency. The scope of the improvements can range from work that affects a single part of a building's energy-using infrastructure (such as lighting) to a complete package of improvements for multiple buildings and facilities.

Moreover, an EMS contract defines the method for establishing the baseline costs, the cost savings, and the distribution of the savings to the parties involved. The contract also specifies the method for determining savings and addresses contingencies such as utility rate changes and variations in the use and occupancy of a building. While several excellent guides exist for selecting and negotiating energy performance contracts, they are no substitute for the assistance of experienced legal counsel when deliberating a large or complicated contract.[4]

To determine energy or demand savings, compare measured energy use or demand before and after implementation of an energy savings program. In general:

$$\text{Savings} = \text{Baseline Energy-Post Installation Energy} \pm \text{Adjustments}$$[5]

Two fundamental factors drive energy savings: performance and usage. Performance describes how much energy is used to accomplish a specific task; usage describes how much of the task is required, such as the number of operating hours during which a piece of equipment operates. For example, in the simple case of lighting, performance is the power required to provide a specific amount of light, and usage is the operating hours per year. For a chiller (which is a more complex system), performance is defined as the energy required to provide a specific amount of cooling (which varies with load), whereas usage is defined by the cooling load profile and the total amount of cooling required.[6]

To determine if an EMS contract is right for you, you will want to gather a variety of information. Using a preliminary feasibility survey helps evaluate the viability of using a performance based contract. Begin by determining various building aspects, such as, energy consumption, use and occupancy, recent energy improvement updates, space conditions, equipment inventory, and any planned remodeling. Collect historical energy data to calculate energy use, cost, and cost per square

[3] See glossary.
[4] Source: U.S. Department of Energy, Energy Smart Schools Program
[5] FEMP M&V Guidelines: Measurement and Verification for Federal Energy Projects, Version 3.0, U.S. Department of Energy
[6] Ibid

foot. This information provides the energy intensity of a building.[7] An on-site walk-through provides an inventory of energy systems, equipment, and usage. This initial examination combined with historical energy use data aids in determining whether sufficient opportunity for energy savings exists. Gathering basic information is important for energy management; however, you will need an in-depth audit later in the contract process. Section II: Understanding How Buildings Use Energy, on page 6, explains various building aspects.

If sufficient opportunities for energy savings materialize, engage on-site staff and organize a team responsible for the different aspects of the EMS contract. Typically, this includes the following individuals:

- Person with authority to execute a contract/make major decisions
- Facility and maintenance staff
- Technical resource
- Legal resource
- Financial resource
- Procurement resource, and the
- Individual responsible for monitoring the project

The contribution of each resource changes throughout the term of the contract, with continuing participation by the monitor responsible for assessing outcomes once construction is completed. When the savings period begins, the monitor will need the expertise to verify the ESCO's annual performance reports to determine the outcomes of the project. An outside independent consultant may be used if in-house staff is not sufficiently experienced.

Once opportunities emerge and the project management team is organized, the RFR/RFQ process begins. DOER offers model documents. ***These model documents do not replace legal and technical expertise but only provide guidance.***

**Sources of Financing**

There are various methods to finance an Energy Management Services project, including:

- **Loan**: The Awarding Authority obtains a loan to cover the cost of all conservation and electrical power generation improvements and equipment related to the performance contract.
- **Third Party Lease**: The Awarding Authority enters into a third party lease for conservation and electrical power generation improvements and equipment. Energy savings fund lease payments over the life of the lease.
- **Turnkey Agreement**: The Awarding Authority and the ESCO enter into a turnkey agreement whereby the ESCO owns the conservation and electrical power generation improvements and equipment related to the performance contract and leases it to the Authority

If the ESCO provides the financing, it is termed 'off balance sheet' or 'non-recourse' financing. The ESCO can use its own funds, borrow money, or sign a leasing arrangement. The Awarding Authority has no debt, and its only obligation is to pay the ESCO all or part of the savings during the contract

[7] The U.S. Environmental Protection Agency (EPA) offers a free on-line comparison calculator at www.epa.gov . The EPA's **Energy Star Program Portfolio Manager** will benchmark the selected site.

period.[8] ***In all cases, the ESCO guarantees that the energy cost savings provide enough cash flow to repay the financing as well as to cover fees and costs.***

**Suitable Projects**

In general, an EMS contracting arrangement is appropriate for projects that can: (a) produce reliable, significant, and long term energy-related cost savings; and (b) capture all economically viable energy system improvements in an organization's entire stock of buildings and facilities. Because EMS contracting offers continuing operations and maintenance services, it provides a valuable opportunity to capture long-term savings that may accrue to an organization.

Energy Management Services contracts are significant for organizations that:

- Lack necessary technical expertise
- Need to free up in-house resources for other priorities
- Lack the time to supervise or manage comprehensive improvements
- Are unwilling or unable to finance the initial costs of those improvements

Determining whether an EMS contract is appropriate for an organization's needs often depends on project size, the number of measures to be installed, and long-term building use.

**Project Size**

***It is important that projects carried out under an EMS contract be of sufficient size for the savings generated to cover both the equipment upgrades itself and the project costs.*** Aggregating smaller projects together into a single contract and streamlining the bidding and assessment process by using standard practices may minimize costs. Project size is one determinant of whether an EMS contract is the best financing measure for a particular investment. While this type of contract is generally most appropriate for larger buildings or a set of buildings, smaller projects can also benefit from an effectively executed program.

**Multiple Measures**

Multiple measures can improve all energy-using systems within a building (i.e., lighting, heating and cooling, controls, etc.). EMS contracts often contain measures with short-term paybacks that offset improvements with long-term paybacks. Multiple measures with a composite (combined) economic payback of up to seven years and individual measures with longer paybacks are good candidates when the expected life span of the measure exceeds its cost-recovery period.[9]

**Stable Building Use**

Building use is another determinant of the efficacy of EMS contracting. Improving buildings using this type of contract is generally more appropriate for buildings that have relatively stable use and occupancy during the contract period. Major changes in building use significantly affect energy consumption and require modifications to the originally agreed-upon baseline and/or savings and performance guarantees negotiated with the contractor.

Building owners considering multi-building projects may want to establish a master financing agreement with a single firm. Bid specifications can detail the extent of the contracting effort. Often, multi-building project financing significantly reduces transaction time and costs for both the building owner and ESCO.[10]

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[8] Typically a separate agreement is arranged with a financier. The EMS Contract may be structured to be budget neutral or to provide a cash flow from the savings.

[9] See Energy Management Basics for Municipal and State Planners and Managers in Massachusetts at www.mass.gov/doer

[10] Financing Energy Efficiency in Buildings, (May 1998), U.S. DOE

## II: UNDERSTANDING HOW BUILDINGS USE ENERGY

Before determining how to reduce energy consumption, you will require some baseline[11] information to understand where things stand and what measures can help you reduce energy use. The information needed includes the characteristics of your building and the amount of fuel and electricity consumed.

The following table is an example of the type of information to record fuel consumption and cost data. Enter fuel codes for electricity (E), natural gas (N), distillate oil (D#2, D#4), etc. Enter the year and month of the data and the quantity in kilowatt-hours, gallons, therms or CCF, etc. **This information is required for both an RFP (3 years) and an RFQ (2 years).**

**Table 1: Fuel Consumption and Cost Data**

**Building Name:** _____

**Year:**

| | **Fuel Code** | **E (electricity)** | **Fuel Code** | **N (natural gas)** | **Fuel Code** | **D (distillate oil #2)** | **Fuel Code** | **QTY** |
|---|---|---|---|---|---|---|---|---|
| **FY Year** | **Qty(kWh)** | **Cost** | **Qty (CCF)** | **Cost** | **Qty (gals)** | **Cost** | **Qty** | **Cost** |
| July | | | | | | | | |
| August | | | | | | | | |
| September | | | | | | | | |
| October | | | | | | | | |
| November | | | | | | | | |
| December | | | | | | | | |
| January | | | | | | | | |
| February | | | | | | | | |
| March | | | | | | | | |
| April | | | | | | | | |
| May | | | | | | | | |
| June | | | | | | | | |
| **Total** | | | | | | | | |

Use building plans and first-hand measurements and observations to determine:

- **Building age and general condition:** include the types of windows, roofing, and wall material and the approximate percentage of glass to wall space.

[11] See glossary

- **The total conditioned area (heated and cooled interior) of the building:** measured in square feet, not including unheated basement or attic space.

- **The average daily number of occupants:** include normal operating hours and any weekend or special events.

- **The number of hours each day your building is used:** include weekdays, weekends, special holidays, and evening hours.

- **Brief descriptions and the locations of:**
  - ✓ Primary heating systems
  - ✓ Cooling systems
  - ✓ Ventilation systems
  - ✓ Lighting
  - ✓ Hot Water

- **Brief descriptions of any special systems:** include energy using areas such as laundries, kitchens, elevators, machine and electric shops, greenhouses, swimming and locker areas, etc.

This information gives you a building profile to help you spot potential areas of energy waste for each building involved.

## III: THIRD PARTY FINANCING OVERVIEW

Third-Party Financing is an alternative means of financing energy and water conservation projects. For this method, an Energy Services Company may assist the building owner to arrange financing through a third-party banker/financier. The building owner agrees to accept responsibility for the payments and, in return, the ESCO guarantees the building owner a certain level of savings. The ESCO's return from the project is determined by the amount of energy and water savings generated by the improvements. Procedures for calculating savings and returns are included in the terms of the contract. The contract typically contains a non-appropriation clause based on a conditional (the energy savings guarantee) agreement.

The financing agreement is a stand-alone agreement, separate from the EMS contract, between the financier and the Awarding Authority. The two agreements are linked through the payment schedules and the savings guarantee provided by the ESCO. The financing is typically provided by an institution familiar with, or expert in performance contracting (EMS).

While budget and resource constraints make investing in energy efficiency projects a challenge, Third-Party Financing offers several benefits. This type of contract enables an owner to upgrade energy and water-related equipment and the building envelope with little or no up-front investment. The ESCO designs, installs, and, if required, operates the new technology and guarantees the annual savings in energy and water. Eventually the owner assumes management of the buildings with reduced energy and water consumption, and with staff trained to operate and maintain the new equipment. The ESCO is compensated according to the agreed upon payments in the EMS Contract.

The ESCO often manages the operation of the improvements to ensure the realization of anticipated savings. To mitigate risks for both parties, the contract may also include other clauses that address such issues as buy-out or early termination options. Payment and operating requirements vary from contract to contract. **By using a RFR/RFQ process, the Awarding Authority can pursue an approach that provides the opportunity to evaluate several alternatives and choose a satisfactory package that meets the criteria of all parties involved.**

Ordinarily, the savings are determined by using a standard Measurement and Verification Protocol (M & V) that identifies energy and/or water consumption baseline by using historical utility billing data. Adjustments to this data reflect changes in usage patterns, weather conditions, and building function so that the savings are not over or under estimated. The International Performance Measurement and Verification Protocol (IPMVP) provide an overview of current best practice techniques available for verifying the results of energy efficiency, water efficiency, and renewable energy projects. In addition, facility operators may use it to assess and improve facility performance. MGL c. 25A, s. 11I requires that methods for measurement and verification of energy savings shall conform to the most recent standards established by the Federal Energy Management Program (FEMP), which are an application of the IPMVP. The FEMP M&V Guidelines may be found at http://www1.eere.energy.gov/femp/financing/superespcs_measguide.html

**Cost-Benefit Analysis Methods**

The major function of investment analysis is to determine which projects have greater benefits than costs (e.g., the most profitable investments). The cost-benefit method for evaluating project alternatives can range from simple to sophisticated. The following examples summarize three primary

cost-benefit methods that may be used separately or together. These methods include simple payback analysis, internal rate of return (IRR), and net present value (NPV).

**Simple Payback**

Using the simple payback method[12], divide a project's total cost by the energy-cost savings accruing to it in the first year after it has begun. A simple payback calculation provides a rough initial estimate of the time needed to recover the initial investment. This cost-benefit method is a valuable tool in marketing energy projects since individuals with minimal financial expertise easily understand it. However, investors are likely not interested in projects presented with simple payback scenarios because of the following drawbacks:

- Simple payback analysis does not reflect savings that will continue to accrue to the project after reaching the payback point. If the payback periods for two different projects are 2.5 years and 4 years, respectively, a decision based on simple payback ignores cumulative lifetime savings. Disregarding the benefits that accrue over the useful life of a project encourages smaller total savings through cream skimming.

- Simple payback analysis does not take into account the time value of money. This is a crucial drawback, especially in cases where the dollar value of a project is large and/or the useful life of the improvements is long. In order to properly compare the economic benefits of competing long-range upgrade projects, you need to discount the value of future dollars relative to today's dollars.

**Internal Rate of Return**

Internal rate of return (IRR) is a cost-benefit method that evaluates the profitability of capital expenditures over their useful lives. It essentially gives an annualized rate of return for an investment based on life-cycle payments (negative cash flows) and income (positive cash flows from energy savings). IRR is the rate of return at which the sum of discounted future cash flows equals the initial investment outlay. Most government and private sector organizations set internal return rates that must be met. IRR gauges the useful life of an improvement and incorporates the time value of money.

**Net Present Value (NPV)**

Net present value (NPV) is a profitability indicator that takes into account both life-cycle cash flows and the time value of money. The higher the NPV, the greater the profitability of an investment. The following table, Table 2 on page 10, compares the profitability of a non-comprehensive and a comprehensive project using NPV calculations.

Calculate NPV by adding the initial investment (always a negative cash flow) to the present value of anticipated future cash flows (estimated savings) over the useful life of an improvement. In this example, this investment is $100,000 for just a lighting system and $400,000 for the comprehensive project and the useful life is assumed at ten years. The initial investment and annual cash flows are discounted at a rate of 12% to derive the present value for each year. The sum of the annual cash flow values gives the NPV.

Table 1 illustrates the effect of discounting on consecutive yearly cash flows. The discount rate of 12% reflects the organizations required rate of return that must be met before they will invest in a project. The key to performing this type of discounted cash flow analysis is to use a basic discounting formula, which is 1/(1+r) n (where r = discount rate and n= number of years). Use of this formula yields a

[12] The time it takes for the savings from an energy conservation measure to pay for the cost of the investment to implement that measure.

discount factor. By multiplying the projected yearly cash flow by the discount factor, the present value for that year is determined. Discounting accounts for the time value of money by adjusting the worth of future dollars to the value of today's dollars. The sum of the discounted annual cash flows (including the original investment or outflow) yields the NPV for the investment, and clearly shows the higher profitability of the more comprehensive project.[13]

**Table 2: Calculating Net Present Value**

| | Lighting System Only | | | Comprehensive Retrofit | | |
|---|---|---|---|---|---|---|
| **Year** | **Cash Flow** | **Discount Factor (@12% rate)** | **Present Value of Cash Flows** | **Cash Flow** | **Discount Factor (@12% rate)** | **Present Value of Cash Flows** |
| 0 | -$100,000 | 1.000 | -$100,000 | -$400,000 | 1.000 | -$400,000 |
| 1 | 40,000 | .893 | 35,720 | 100,000 | .893 | 89,300 |
| 2 | 40,000 | .797 | 31,880 | 100,000 | .797 | 79,700 |
| 3 | 40,000 | .712 | 28,480 | 100,000 | .712 | 71,200 |
| 4 | 40,000 | .636 | 25,440 | 100,000 | .636 | 63,600 |
| 5 | 40,000 | .567 | 22,680 | 100,000 | .567 | 56,700 |
| 6 | 40,000 | .507 | 20,280 | 100,000 | .507 | 50,700 |
| 7 | 40,000 | .452 | 18,080 | 100,000 | .452 | 45,200 |
| 8 | 40,000 | .404 | 16,160 | 100,000 | .404 | 40,400 |
| 9 | 40,000 | .361 | 14,440 | 100,000 | .361 | 36,100 |
| 10 | 40,000 | .322 | 12,880 | 100,000 | .322 | 32,200 |
| **Total** | **$300.000** | | **$126,040** | **$600,000** | | **$165,100** |

***Discount Factor=1/(1+r)$^n$*** Source: USDOE

**In Summary**

Energy Management Services through Third-Party Financing enables installation of efficiency improvements without requiring any up-front investment. Unique to this type of financing is the guaranteed net positive cash flow. The customer is only obliged to pay the ESCO (or Third-Party financier) a portion of the energy and water cost reductions actually achieved for the duration of the contract. Because the project's savings are contingent upon the proper maintenance of the water and energy-related equipment, there is a strong incentive for ESCOs to maintain such equipment and to choose long-lasting, high-performance equipment, as part of the project.

[13] Financing Energy Efficiency in Buildings, (May 1998), U.S. DOE

## VI: ADVANTAGES AND DISADVANTAGES OF PERFORMANCE TYPE CONTRACTS

Using an EMS contracting arrangement streamlines the process for installation of energy conservation improvements and enables one to deal with a single company. While most companies are reputable, some ESCOs have taken advantage of owners by failing to explain or inform them of the key technical and financial decisions necessary in developing a project. Despite these drawbacks, EMS Contracting has a number of advantages. EMS, using MGL c 25A, §11C or §11I simplifies the method for funding energy and water efficiency improvements when working within tight budget constraints. It also allows for a more comprehensive project.

**Benefits**

Expressly discuss any benefits with the ESCO to ensure they are met. You may want to consider an Energy Management Services Contract for the following reasons:

- **Accountability** – The ESCO is the single point of financial and technical accountability for all project measures.
- **Risk Reduction** – By guaranteeing a minimum level of performance, the ESCO takes away much of the risk of project non-performance from the owner.
- **No Capital Outlay** – EMS contracting eliminates capital investments by providing an alternative method of financing projects.
- **Equalized Cash Flow** – Payments for services are structured to maintain a constant fee schedule funded from actual savings realized.
- **Technical Risk** – An ESCO's main job is managing technical risk – The EMSC shifts that risk from your organization to the ESCO. The ESCO assumes the risk that the project performs as designed, while remaining within budget and that the equipment operates properly after installation.
- **Project Financing** – Cash flow demonstrates the intrinsic value to energy savings projects most clearly. While most energy savings projects are funded like capital works upgrades, ESCOs can demonstrate how to fund an energy savings project out of cash flow rather than capital expenditure. If structuring the funding as an operating lease, the project then becomes fully self-funded rather than a debt on your balance sheet.
- **Guaranteed Savings –** EMS Contracts involve a guarantee of achieved savings by the ESCO. This is normally structured so the loan repayment is less than, or equal to, the savings guarantee amount. In this way, you are assured of being able to meet your loan or lease payment obligations from the savings generated by the project. This is important if you are skeptical about the ability of identified improvements to achieve the energy savings claimed under a traditional tendered approach.
- **Expertise –** Since energy efficiency is its core business, the ESCO brings expertise to a project. While consulting engineers can offer similar expertise, and indeed frequently work for ESCOs, using a performance contracting arrangement enables one to streamline and deal

with only one company. In addition, because the ESCO is interested in a partnership with the building owner and is always looking to improve the performance of the project, it can bring a level of continuous improvement that would ordinarily not happen.

- **Environment –** Environmental benefits achieved by reduced energy consumption include a reduction in greenhouse gas emissions (either directly from burning fossil fuels on-site or indirectly from electricity that is generated from fossil fuel power stations), reduced water consumption, reduced chemical use and reduced solid waste. [14]

**Drawbacks**

Unfortunately, the problems of implementing an Energy Services Management Contract are well documented. When selecting this financing option, avoid the following drawbacks:

- **Energy Baseline Development – Establishing an energy baseline is *crucial* for project development since energy savings are an estimate between actual use and the energy baseline (the energy usage if the energy conservation measures had not been implemented).**

- **Adjustments to the Energy Baseline** – Define clearly the method of adjusting for changes in weather, occupancy, etc. (see FEMP M&V Guidelines)

- **Operational Savings –** Recurring savings generally result from reduced O&M expenses – these savings must be based on actual spending reductions.

- **Cost Avoidance** – This term applies to implementing measures that allow owners to avoid future costs, but does not save hard dollars compared to past budgets.

- **Excessive Finance Charges** – Check interest rates on the funds borrowed against local banks or other national institutions to assure the competitiveness of finance charges.

- **Required Maintenance Agreements** – Maintenance agreements may be expensive in relation to the value provided. The ESCO may claim that they cannot assure guaranteed savings unless their own staff performs the maintenance (a genuine concern). Other ESCOs guarantee savings while providing training for maintenance staff so they can handle maintenance requirements.

- **Terms of Savings Reconciliation Versus Budget Cycle** – Several standard ESCO performance contracts allow the ESCO to carry over savings that occur in early years to offset losses in later years. ***These terms do not benefit the Awarding Authority. In Massachusetts all savings must be reconciled annually and stand alone on that basis.***

- **Quality Control** – Before entering into a contract, ask the ESCO to provide detailed descriptions of both products and services proposed. ***Poorly defined contracts may mean lower quality products.***

[14] A Best Practice Guide to Energy Performance Contracts, Commonwealth of Australia 2000, Australasian Energy Performance Contracting Association

**Cream Skimming**

"Cream skimming" is often an undesirable yet all too common practice of investing in simple projects with relatively low initial costs and quick paybacks. While such investments are financially attractive in the short term, pursuing them may prevent a building owner from capturing significant long-term benefits likely to result from comprehensive retrofits. Cream-skimming projects have impressive initial returns on investment, yet they commonly yield lower absolute energy and cost savings when compared to all-inclusive projects. ***Moreover, due to their emphasis on short-term paybacks, cream skimming weakens an organization's ability to finance more capital-intensive improvements that leverage the value of those short-term paybacks.***

By utilizing bundling, project managers can more fully realize energy and cost savings objectives, while also meeting reasonable payback criteria. ***Bundling refers to the practice of including both short- and long-term energy-efficiency measures in the same project planning and financing scheme.*** When planning a comprehensive energy-efficiency project, using paybacks from short-term measures, like lighting system retrofits, offset costs for more system-wide measures with longer payback periods. By bundling all energy-efficiency measures for a single project into one financially viable package, projects can realize a more attractive total return[15] that allows for a comprehensive project.

**Risk Sharing and Assurances**

Among the key barriers to investment in energy efficiency improvements, are uncertainties about attaining projected energy savings and apprehension about potential disputes over these savings.[16] **Risk** is a measure of the potential inability to achieve overall program objectives within defined cost, schedule, and technical constraints and has two components: (1) the *probability/ likelihood* of failing to achieve a particular outcome, and (2) the *consequences/impacts* of failing to achieve that outcome.[17] In any performance contract, the ESCO takes on the risk of not achieving the expected savings. A contract can take account of factors that would affect the savings such as warmer winters or cooler summers, or changes in the use of the building. There are several ways to diminish risk, including the use of due diligence when assessing the project.

There is an increased use of technical strategies to reduce the risk of underperformance in energy savings projects. These include a host of diagnostics and commissioning processes that detect potential causes of underperformance and remedy them early on. The inclusion of commissioning in the ENERGY STAR Buildings process, and basing the Building Label on actual (measured) energy use are prominent examples of this trend. The International Performance Measurement and Verification Protocol (IPMVP) is another type of technical strategy to reduce performance risk. Financial strategies are also increasingly used to reduce the risk of underperformance.

- **Performance Bonds** – Performance Bonds offer another method of risk transfer applied to the construction phase of an energy savings project and are required under c. 25A.

- **Performance Guarantees** – Guarantees are offered by providers of energy management services, who retain the risk. ***In Massachusetts, all EMS project savings are guaranteed.***

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[15] Financing Energy Efficiency in Buildings, May 1998, U.S. DOE

[16] Risk Transfer via Energy Savings Insurance, October 1, 2001, Evan Mills, Energy Analysis Department, Lawrence Berkeley National Laboratory at http://eetd.lbl.gov/insurance.

[17] Risk Management Guide for DOD Acquisition, Fourth Edition, February 2001, Department of Defense, Defense Acquisition University, Defense Systems Management College

## V: OVERVIEW OF THE DECISION PROCESS

Figure 2 on the following page illustrates the decision process for EMS. For the most effective application of an EMS project, a site should have:

1. Two or more years of stable energy consumption of greater than average use;
2. Reliable records of energy consumption;
3. On-site staff who are familiar with operations and are willing to provide assistance;
4. Predictable occupancy patterns;
5. A number of potential capital improvements;
6. No plans for major-structural improvements for the length of the contract (usually 5 to 10 years). (Please note: major structural improvements will distort savings calculations)

Once the site selection is completed, write an RFR/RFQ for the project. The solicitation must contain a general description of the buildings, site-specific information regarding energy and water consumption and cost, minimum energy and water service and related requirements, and facility occupancy and use patterns. This data provides the ESCOs with an understanding of the facility and allows them to evaluate their interest in the project. **The Awarding Authority must send a copy of the RFR/RFQ to the Department of Energy Resources one week before publishing.** Once the Awarding Authority receives acknowledgement of their filing requirements, the solicitation is posted it in a conspicuous place in or near the offices of the Awarding Authority and published it in the Central Register.

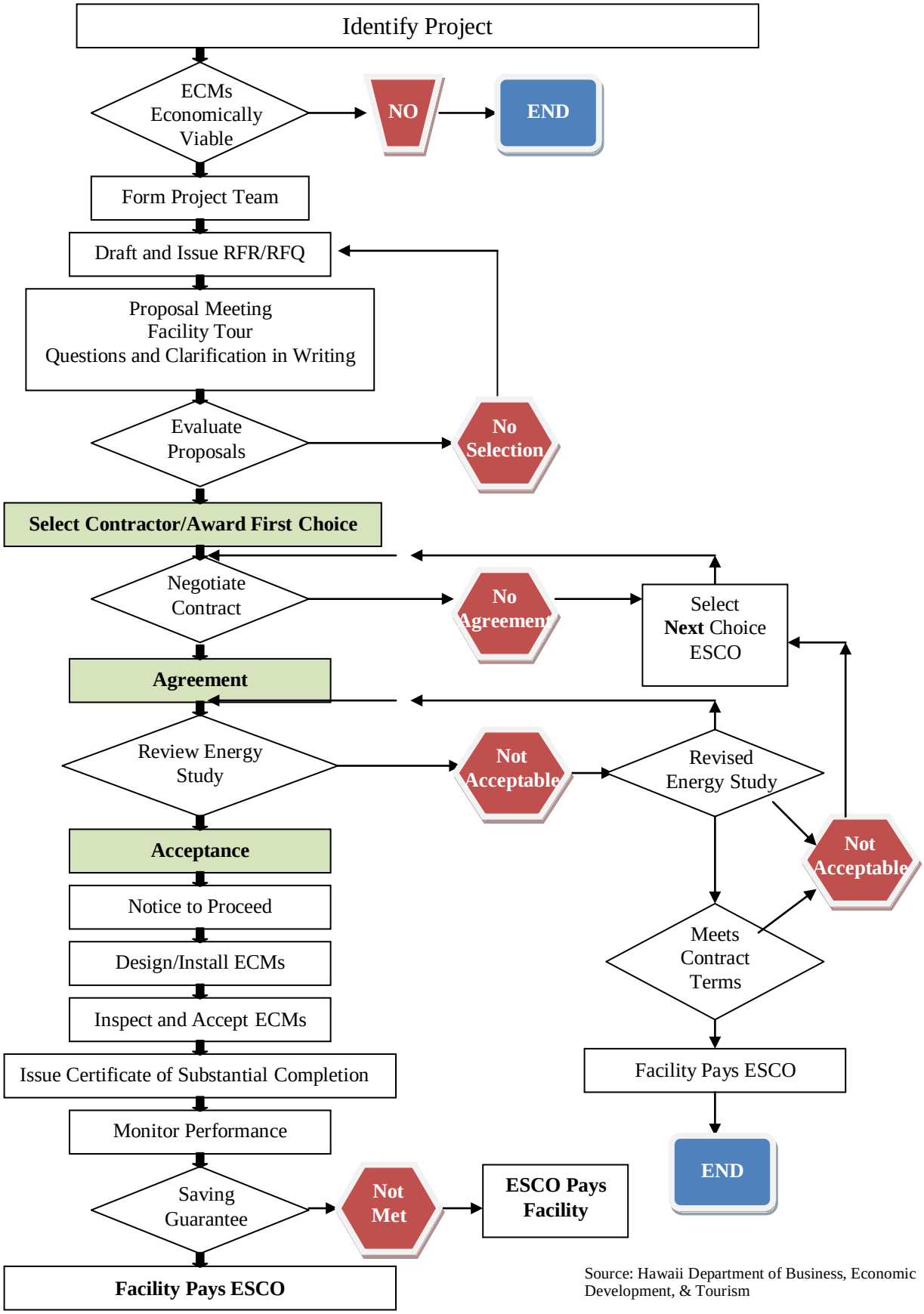
The next step is to invite all interested contractors to attend a pre-response meeting and to tour the facility, so that they may gain a better understanding of site and facility characteristics. ***Note: Pre-response meetings and facility tours are not required but, if held, must be open to all interested firms.*** Make sure to record all inquiries and responses during the pre-response meeting and facility tour and send copies to all contractors that have expressed an interest in the project. Also, make any changes needed to the original RFR/RFQ at this time and distribute a list of these changes, as an addendum, to all parties in receipt of the RFR. ***Note: State preferred method, such as delivery by using registered mail.***

Following this process, ESCOs submit their responses. Allow at least four (4) weeks or longer for ESCOs to submit responses, depending upon the complexity of the project and required certifications. Publicly open the responses in the presence of at least two (2) witnesses at the time specified in the RFR. Make sure to record the date and time of receipt for each response – reject all responses received after the deadline stated in the RFR.

Engineers and staff (including the participating facility and project team members) then evaluate the responses. The first step is to make sure that all of the mandatory minimum qualifications listed in the RFR/RFQ are satisfied. The responses are then evaluated against minimum criteria, plus any other criteria the Awarding Authority determines necessary. Responses must be evaluated according to the criteria in the RFR/RFQ.

After selecting the winning response, the ESCO is responsible for completing a thorough investment grade energy audit (IGA) of the facility. If substantial savings exist, use of Energy Management Services Contract (EMSC) implements the efficiency improvements identified in the audit.

**Figure 2: Decision Process**




Source: Hawaii Department of Business, Economic Development, & Tourism

## VI: SOLICITATION DRAFTING GUIDELINES

Have the team develop RFR/RFQ specifications – ***do not leave this up to the ESCO***. To ensure full and fair competition among vendors and provide a basis of comparison for responses, M.G.L. c.25A §11C and § 11I sets out a number of minimum requirements for the contents of RFR/RFQ. DOER provides model documents on the web site at mass.gov/doer/Energy Management Services.

1. Solicitations must describe the required services without "having the effect of requiring a proprietary supply of service, or procurement from a sole source." Provisions that pertain to performance guarantees may conflict with the statute if they eliminate all competitors except affiliates of particular manufacturers of energy conservation equipment. Note: However, this is not meant to restrict high efficiency standards in the project specifications.

2. Awarding Authorities must file:
   - A copy of the RFP/RFQ with DOER one week before publishing (eileen.mchugh@state.ma.us)
   - A copy of the contract (including IGA) thirty days after signing agreement
   - An annual energy savings report[18]
3. Public Agencies must evaluate responses and award the contract based solely on the criteria set forth in the RFR/RFQ.

A model RFR, RFQ, and EMSC are available on DOER's public web site at www.mass.gov/doer. To obtain a word version of the boilerplate RFP or RFR for your own edits please email a request, with subject line "Energy Management Services", to DOER at eileen.mchugh@state.ma.us.

**Steps**

Both the RFP and the RFQ must contain:

- The name and address of the public agency
- The name, address, title, and phone number of a contact person
- The date, time, and place where proposals/qualifications must be received
- A description of the services
- A facility profile with a description of each building
- **Accurate energy consumption data for the most recent 3 year period for an RFP, and the most recent 2 year period for an RFQ**
- The evaluation criteria for assessing the qualifications
- A statement that the public agency may cancel the request for qualifications when the public agency determines that cancellation or rejection serves the best interests of the public
- Any other stipulations and clarifications the public agency may require, which shall be clearly identified in the request for qualifications

Other requirements:

- File a copy of the RFP or RFQ to DOER one week prior to publication

[18] The reporting form is at http://www.mass.gov/?pageID=eoeeaterminal&L=4&L0=Home&L1=Energy%2C+Utilities+%26+Clean+Technologies&L2=Energy+Efficiency&L3=Local+%26+State+Energy+Efficiency&sid=Eoeea&b=terminalcontent&f=doer_ems_energy_management_services&csid=Eoeea

- Issue RFP or RFQ; publish in the Central Register
- Review written responses and select top candidates
- Interview top candidates
- Select a respondent
- Contract to implement projects through an Energy Management Services Contract

| **Minimum requirements for evaluating an RFQ include:** | **Minimum requirements for evaluating an RFP include:** |
|---|---|
| • References of other energy savings contracts performed by the qualified providers;<br>• The certificate of eligibility and update statement provided by the qualified providers;<br>• Quality of the products proposed;<br>• Methodology of determining energy savings;<br>• General reputation and performance capabilities of the qualified providers;<br>• Substantial conformity with the specifications and other conditions set forth in the request for qualifications;<br>• Time specified in the qualifications for the performance of the contract; and any other factors the public agency considers reasonable and appropriate, which factors shall be made a matter of record. | • Total project price<br>• Estimated savings/production<br>• Price data<br>• Statement of objectives on which responses will be evaluated<br>• References of other energy savings contracts performed by the qualified providers;<br>• The certificate of eligibility and update statement provided by the qualified providers;<br>• Methodology of determining energy savings;<br>• General reputation and performance capabilities of the qualified providers;<br>• Substantial conformity with the specifications and other conditions set forth in the request for proposal; time specified in the proposal for the performance of the contract; and any other factors the public agency considers reasonable and appropriate, which factors shall be made a matter of record. |

**Improving the Process**

In addition to the requirements of the statute, the following procedures are designed to improve the process by ensuring full and fair competition in fact as well as appearance:

1) Avoid unduly restrictive provisions. *Example*: A provision requiring the manufacturer of energy equipment to guarantee satisfactory completion of services if the ESCO of those services fails to complete the contract. As a practical matter, manufacturers warranty equipment not the performance of the contract.

*Possible Solution:* The requirement of an appropriate performance bond provides protection for the public interest.

2) Request rather than require letters of intent to bid. This keeps the field of potential vendors open as long as possible, and maximizes competitive pressures on price.

3) Provide ESCOs with as much notice as possible for attendance at pre-bid meetings. ESCOs generally need at least three (3) weeks notice in order to attend meetings. The amount of notice is especially important in cases where failure to attend is grounds for automatic disqualification.

4) While the statute establishes a minimum for the submission of a response in answer to a solicitation, as a practical matter a longer period may be beneficial. Preparation of a bid to provide Energy Management Services requires a thorough understanding of the current operations and energy usage of the facilities.

   In other comparable competitive processes, it is not unusual to allow at least one (1) to two (2) months for preparing such a bid. If the response period is too brief, vendors who are already familiar with the facility and its operation may have an undue advantage over other competitors in preparing its bid.

5) Given that the implementation of many Energy Management Services projects occur outside of the heating season, early planning for the procurement process is essential. If a project must be completed in time for the following heating season, then issue a solicitation no later than March of that year.

M.G.L. c.25A §11C and § 11I and 225 C.M.R. 10.03 authorizes DOER to have a consultative role, at the election of the Awarding Authority, regarding the content of RFRs/RFQs for Energy Management Services.

## VII: ENERGY AUDIT

After the selection process is complete, deciding on capital improvements requires further study by a professional engineer or architect and the attention of financial and administrative personnel. The objective is to select the most cost-effective capital improvements. The ESCO needs information to carefully evaluate each measure so one is able to select those improvements that save the most energy at the least cost. An Investment Grade Audit (IGA) is the further study to determine the nature, costs, and savings presented by these improvements.

To obtain the best information, the ESCO provides an on-site professional investment grade technical audit. An engineer or architect trained in the design and maintenance of mechanical and electrical systems conducts an objective and detailed on-site audit of the building (s), quickly recognizing the sources of energy waste and the options available to correct them.

Expect to receive a complete, professional audit report that includes:

- A detailed analysis of the energy profile of the building, including consumption analysis at current levels and at levels of optimal efficiency.
- A listing of O&M measures not already identified, along with potential savings.
- A description and analysis of all applicable capital measures, including estimated costs of design, acquisition, and installation.
- The expected useful life of each capital improvement, and
- The estimated savings over the useful life of the improvement.
- The method used to derive these estimates.

In addition, the auditor can look at such options as solar and renewable energy projects and bring to your attention any zoning ordinances, building codes or other regulations that pertain to your plans or the possible need for an environmental study.

Not only does the IGA focus on the specifications for a particular capital investment, but also the overall potential efficiency of the building and ways in which to improve it. Since energy systems are highly interrelated, evaluating one possible alteration must include an analysis of how that change might affect other parts of the energy system. For example, doing major work on part of the HVAC system may require that the entire system be rebalanced by a qualified HVAC technician, or excessive delamping in an area with incandescent lights may increase the heat demand for that area due to the loss of heat from removed lamps.

**The IGA and audit report becomes part of your Energy Management Services Contract as an attachment or schedule. If the project is abandoned, the ESCO usually receives an audit fee (the amount agreed upon by both parties).**

## VIII: SAVINGS CALCULATION OPTIONS

The problem of identifying and capturing energy savings is very real. Measuring and verifying savings from EMS projects requires special project planning and engineering activities. Proper savings determination is a necessary part of good design of the savings program itself. M.G.L. c. 25A, §11I stipulates the use of the most recent version of the Federal Energy Management Measurement and Verification Guidelines (FEMP M&V Guidelines), which is an application of the International Performance Measurement and Verification Protocol (IPMVP). The Guidelines contain procedures for quantifying the savings resulting from energy efficiency equipment, water conservation, improved operation and maintenance, renewable energy, and cogeneration projects.

Industry best practices are documented in several guidelines, including the International Performance Measurement and Verification Protocol2 (IPMVP 2007) and ASHRAE Guideline 14: Measurement of Energy and Demand Savings3 (2002). These two guidelines are described below.

**IPMVP**

The IPMVP 2007 is a guidance document that provides a conceptual framework in measuring, computing, and reporting savings achieved by energy or water efficiency projects at facilities. The IPMVP defines key terms and outlines issues that must be considered in developing an M&V Plan, but does not provide details for specific measures or technologies. The latest version is an update of the 2002 edition.

Developed through a collaborative effort involving industry, government, financial, and other organizations, the IPMVP serves as the framework for M&V procedures, provides four M&V options, and addresses issues related to the use of M&V in third-party-financed and utility projects.
The FEMP M&V Guideline contains specific procedures for applying concepts originating in the IPMVP. The Guideline represents a specific application of the IPMVP for federal projects. It outlines procedures for determining M&V approaches, evaluating M&V plans and reports, and establishing the basis of payment for energy savings during the contract. These procedures are intended to be fully compatible and consistent with the IPMVP.

**ASHRAE Guideline 14-2002**

ASHRAE Guideline14-2002 Measurement of Energy and Demand Savings is a reference for calculating energy and demand savings associated with performance contracts using measurements. In addition, it sets forth instrumentation and data management guidelines and describes methods for accounting for uncertainty associated with models and measurements. Guideline 14 does not discuss other issues related to performance contracting.

The ASHRAE document specifies three engineering approaches to M&V. Compliance of each approach require that the overall uncertainty of the savings estimates is below prescribed thresholds. The three approaches presented are closely related to and support the options provided in IPMVP.[19]

**Performance Guarantee**

Energy savings from EMS project are **guaranteed** by the ESCO and require that the ESCO verify that energy savings have been achieved each year. Properly applied, M&V can:

- Accurately assess energy savings for a project
- Allocate risks to the appropriate parties

[19] FEMP M&V Guidelines, v. 3

- Reduce uncertainties to reasonable levels
- Monitor equipment performance
- Find additional savings
- Improve operations and maintenance (O&M)
- Verify that the cost savings guarantee is met
- Allow for future adjustments, as needed[20]

**Basic Steps**

The basic approach in savings determination is closely linked with elements of program design. As indicated by the IPMVP, the basic approach common to all good savings determination entails the following steps:

1. Select the measurement and verification option consistent with the intended scope of the project
2. Determine whether to adjust post-retrofit conditions
3. Gather relevant energy and operating data from the baseyear and record it for current and future use
4. Design the energy savings program. Include documentation of both the design intent and methods for demonstrating achievement of the design intent
5. Prepare a measurement and verification (M&V) plan. Include a definition of the word "savings" for each project. Include the information from the previous steps. This plan also defines the subsequent steps
6. Design, install, and test any special measurement equipment needed under the M&V Plan
7. After the energy savings program is implemented, inspect the installed equipment and revised operating procedures to ensure that they conform with the design intent of the energy savings program. This process is commonly called "commissioning"
8. Gather energy and operating data from the post-retrofit period, consistent with that of the baseyear and as defined in the M&V Plan. The inspections needed for gathering this data should include periodic repetition of commissioning activities to ensure equipment is functioning as planned
9. Compute and report savings in accordance with the M&V Plan

**Define the Baseline**

**It is essential to establish baseline conditions for the purpose of estimating savings by comparing the baseline energy use with the post-installation energy use.** Baseline information is also used to account for any changes that may occur during the performance period, which may require baseline energy use adjustments. This baseline information is included in the ESCO's final proposal. It is the Local Governmental Agency's responsibility to ensure that the baseline has been properly defined. If a whole building metering or calibrated simulation approach is used, it is important to document the baseline energy use of all end uses, not just those affected by the retrofit.

After implementing the energy conservation measure (ECM), one cannot go back and reevaluate the baseline. It no longer exists! **Therefore, it is very important to properly define and document the baseline conditions.** Deciding what needs to be monitored (and for how long) depends on such factors as the complexity of the measure and the stability of the baseline, including the variability of equipment loads and operating hours, and the other variables that affect the load.

[20] Ibid

The primary sources of questions and complaints on EMS projects are the occasional situations where the customer does not think that savings are being realized. Adequate documentation of the baseline is critical to resolving any such disagreements that may arise.[21]

**M&V Plan**

**Other than developing the baseline, the M&V Plan is the single most important item in an energy savings guarantee**. The plan defines how savings are calculated and specifies any ongoing activities that will occur during the contract term. Since the primary purpose of measurement and verification (M&V) is to validate payments or performance guarantees, the cost of M&V should be less than the payment amount or guarantee that is at risk.

Although the M&V Plan is usually developed during contract negotiations, it is important that the agency and the ESCO agree upon general M&V approaches to be used prior to starting the Investment Grade Audit (IGA). The M&V method(s) chosen will determine what activities are conducted during the audit, and will affect the cost and duration of the audit.

The project-specific M&V Plan includes project-wide items as well as details for each ECM. Project-wide items include:

- Overview of proposed energy and cost savings
- Schedule for all M&V activities
- Agency witnessing requirements
- Utility rates and the method used to calculate cost savings
- O&M reporting responsibilities

ECM-level items include:

- Details of baseline conditions and data collected
- Documentation of all assumptions and sources of data
- Details of engineering analysis performed
- The way energy savings will be calculated
- Details of any O&M or other cost savings claimed
- Details of proposed energy and cost savings
- Details of post-installation verification activities, including inspections, measurements, and analysis
- Details of any anticipated routine adjustments to baseline or reporting period energy
- Content and format of all M&V reports (post-installation and periodic M&V)[22]

**FEMP M&V Options**

FEMP M&V options provides an overview of current best practice techniques available for verifying results of energy efficiency, water efficiency, and renewable energy projects in commercial and industrial facilities.

[21] Ibid
[22] Ibid

Overview of FEMP options A, B, C, and D:

| M&V Option | Performance and Usage Factors | Savings Calculation |
|---|---|---|
| **Option A – Retrofit Isolation with Key Parameter Measurement** | Based on a combination of measured and estimated factors when variations in factors are not expected.<br><br>Measurements are spot or short-term and are taken at the component or system level, both in the baseline and post-installation cases.<br><br>Measurements should include the key performance parameter(s), which define the energy use of the ECM. Estimated factors are supported by historical or manufacturer's data.<br><br>Savings are determined by means of engineering calculations of baseline and post-installation energy use based on measured and estimated values. | Direct measurements and estimated values, engineering calculations and/or component or system models often developed through regression analysis[23].<br><br>Adjustments to models not typically required. |
| **Option B – Retrofit Isolation with All Parameter Measurement** | Based on periodic or continuous measurements of energy use taken at the component or system level when variations in factors are expected.<br><br>Energy or proxies of energy use are measured continuously. Periodic spot or short-term measurements may suffice when variations in factors are not expected.<br><br>Savings are determines from analysis of baseline and reporting period energy use or proxies of energy use. | Direct measurements, engineering calculations, and/or component or system models often developed through regression analysis.<br><br>May require adjustments to models. |
| **Option – C Utility Data Analysis** | Based on long-term, continuous, whole-building utility meter, facility level, or sub-meter energy or water data.<br><br>Savings are determined from analysis of baseline and reporting period energy data. Typically, regression analysis is conducted to correlate with and adjust energy use to independent variables such as weather, but simple comparisons may also be used. | Based on regression analysis of utility meter data to account for factors that drive energy use.<br><br>Typically requires adjustments to models. |
| **Option D – Calibrated Computer Simulation** | Computer simulation software used to model energy performance of whole-facility (or sub-facility). Models must be calibrated with actual hourly or monthly billing data from the facility.<br><br>Implementation of simulation modeling requires engineering expertise.<br><br>Inputs to the model include facility characteristics; performance specifications of new and existing equipment or systems; engineering estimates, spot-, short-terms, or long-term measurements of system components; and long-term whole-building utility meter data.<br><br>After calibrating the model, the savings are determined by comparing a simulation of the baseline with either a simulation of the performance period or actual utility data. | Based on computer simulation model (such as eQUEST) calibrated with whole-building or end-use metered data or both.<br><br>Requires adjustments to models. |

Source: FEMP M&V Guidelines, V. 3.

[23] Regression Analysis: A technique used to develop a mathematical model from a set of data that describes the correlation of measured variables.

The four M&V options may be applied to almost any type of ECM. However, the rules-of-thumb listed below generally indicate the most appropriate M&V approach for an application.

**Option A** may be applied when the most critical M&V issue is identifying the potential to generate savings, including situations in which:

- The magnitude of savings is low for the entire project or a portion of the project to which Option A may be applied
- The risk of not achieving savings is low

**Option B**, retrofit isolation, is typically used when any or all of these conditions apply:

- For simple equipment replacement projects with energy savings that are less than 20% of total facility energy use, as recorded by the relevant utility meter or sub-meter
- When energy savings values per individual measure are desired
- When interactive effects are to be ignored or are estimated using estimating methods that do not involve long-term measurements
- When the independent variables that affect energy use are not complex and excessively difficult or expensive to monitor
- When sub-meters already exist that record the energy use of subsystems under consideration (e.g., a 277 V lighting circuit, a separate sub-meter for HVAC systems)

**Options C**, billing analysis, is typically used when any or all of these conditions apply:
For complex equipment replacement and controls projects:

- When predicted savings are relatively large (greater than 10% to 20%) as compared with the energy use recorded by the relevant utility meter or sub-meter
- When energy savings values per individual measure are not desired
- Improving the accuracy of a savings estimate happen in two general ways:
  1. By reducing biases, by using better information or by using measured values in place of assumed or stipulated values, and
  2. By reducing random errors, either by increasing the sample sizes, using a more efficient sample design or applying better measurement techniques.[24]

The concerned parties establish the appropriate level for any savings determination. Where the firm performing the energy savings determinations has more experience than the owner does, the owner may seek assistance in reviewing savings reports. Full review of baseline adjustments requires good understanding of the facility and its operations.

***Note: The FEMP M&V document contains examples of the aforementioned options. We suggest a review of this information to help determine which savings calculation is best for your circumstance***.

**Renewable Energy Projects**

EMS guidelines follow the guideline under FEMP for calculating energy saving for renewable energy projects.[25] Public agencies are allowed to use energy management services (performance contracting) for installation of renewable energy projects that reduce facility energy costs and related operation and maintenance expenses

[24] FEMP M&V Guidelines, V. 3
[25] Source: *M&V Guidelines: Measurement and Verification for Federal Energy Projects Version 3.0*

The term "renewable energy" refers to sources of energy that are regenerated by nature and sustainable in supply.

The "performance" aspect of performance contracting refers to energy performance and drives the way in which savings are determined. Since the measurement and verification (M&V) approach calculates and documents energy savings, it is one of the most important activities associated with implementing performance contracts and is a crucial issue in contract negotiations.

Renewable energy projects involve the installation of devices and/or systems that generate onsite energy (e.g., electricity or heat) or displace energy consumption using onsite renewable energy resources.

Examples of technologies include photovoltaics (PV), active or passive solar systems for space conditioning or production of domestic hot water, and wind systems. For additional information on the measurement and verification of renewable energy projects, refer to IPMVP for renewables.[26] The most notable difference between renewable energy projects and other energy conservation measures (ECMs) is that renewable projects supply energy rather than reduce the amount of energy used. Measuring the energy supplied allows for a simplified approach to measuring savings that is not possible with energy efficiency projects. Option B deserves special consideration when evaluating M&V options for renewable energy projects.

Like many projects, the performance of most renewable energy technologies depends on the environmental conditions, such as solar radiation or wind speed. The use of long-term averages of these values is reliable, but any M&V Plan should be structured in such a way as to allocate the risk due to short-term variations in environmental conditions. Therefore, it may be appropriate to stipulate these conditions and verify the performance of the equipment using short-term measurements (e.g., the efficiency of a solar hot water heater). Long-term performance typically needs to be verified.

**Savings Calculations**

There are two general approaches for calculating energy savings from renewable energy projects:

1. Net energy use
2. Normalized savings based on typical environmental conditions and actual performance characteristics

For all renewable energy projects, consideration should be given to the impact of parasitic energy use by the renewable system and to increased operations and maintenance costs due to the addition of new equipment. Demand savings from renewable energy technologies may occur, but, depending on the electric utility's rate structure, the energy must be available and uninterrupted during all peak periods. Accounting for demand savings requires more sophisticated metering that aligns measurement intervals with the utility interval.

1. ***Net Energy Use***
   The first approach involves directly measuring the energy output from the system and quantifying any additional costs incurred or savings realized. This approach is suitable for

[26] International Performance Measurement & Verification Protocol: Concepts and Practices for determining Energy Savings in Renewable Energy Technologies Applications, Volume II, August 2003.

wind, PV, and other electricity generating equipment. The measurement concept assumes that energy (electrical and/or thermal) produced by the renewable system is used at the project site, and displaces energy that would have been provided by an existing source. Savings are determined by measuring the net amount of energy produced by the renewable system and used at the project site valued at prescribed utility rates. This approach eliminates the need for a baseline and places the risk of weather variations on the ESCO.

Utility savings from renewable measures that supply thermal energy (e.g., solar hot water heater) are determined by dividing the energy delivered by the efficiency of the original equipment (e.g., conventional water heater). For projects that may sell excess energy or store energy on-site, additional costs and savings may need to be considered. Cost savings using this approach can be calculated using the following equation.

**Cost Savings Determination Utilizing Net Energy Use**

$$\text{Cost Savings} = (\text{kWh Delivered}) \times (\text{Rate}_{kWh}) + \left\{\frac{\text{Thermal Energy}}{\text{Efficiency Displaced Equipment}}\right\} \times \left(\frac{1\text{kWh}}{3{,}413\text{BRU}}\right) \times (\text{Rate}_{kWh}) + \{\$_{\text{Energy Sold}}\} - \{\$_{\text{Parasitic Loads}}\} - \{\$_{\text{New O\&M Costs}}\}$$

Where:

| | | |
|---|---|---|
| kWh Delivered | = | Electrical energy delivered by the system and used at the facility |
| $\text{Rate}_{kWh}$ | = | Specified cost of the electric energy |
| Thermal Energy | = | Thermal energy delivered by the system in Btu during the performance period |
| Efficiency Displaced Equipment | = | Operating efficiency of the equipment that would have been used |
| 1kBtu/3,414 Btu | = | Conversion between thermal energy (Btu) and electrical energy (kWh) |
| $\$_{\text{Energy Sold}}$ | = | Funds received through the sale of energy sold |
| $\$_{\text{Parasitic Loads}}$ | = | Cost of operation systems and equipment related to renewable technology |
| $\$_{\text{New O\&M Costs}}$ | = | Addition cost of operations and maintenance due to renewable technology |

Source: FEMP

**2.** ***Normalized Savings***

The second primary approach involves calculating normalized savings based on typical environmental conditions and actual performance characteristics of the system. Savings are determined by calculating the difference between baseline energy and demand and predicted or metered energy and demand, with both sets of data adjusted to a prescribed set of conditions. Depending on the type of system, this strategy can use any of the four M&V options.

Normalizing savings in this manor places the risk of weather fluctuations on the federal agency, and requires that the ESCO periodically demonstrate that specified performance characteristics have been met. These performance characteristics and how they will be determined should be specified in the project-specific M&V Plan. Performance parameters that should be specified include efficiency of PV modules, minimum hot-water temperatures, and the content in landfill gases.

The basic energy savings equation (Equation 2-1) can be modified to determine cost savings, as shown in following equation.

**General Savings Equation for Renewable Energy Projects**

Cost Savings= [{Baseline Energy)-(Performance Period Energy) ±Adjustments} x (Rate $_{Energy}$)]-{$\$_{Parasitic\ Loads}$}-{$\$_{New\ O\&M\ Costs}$}

Where:

| | | |
|---|---|---|
| Baseline Energy | = | The calculated or measured energy use of a piece of equipment prior to the implementation of the project |
| Performance Period Energy | = | The calculated or measured energy use of a piece of equipment after the implementation of the project |
| Adjustments | = | Routine and non-routine changes made to the baseline or performance period energy use to account for expected and unexpected variations in conditions |
| $Rate_{kWh}$ | = | Specified cost of electrical energy |
| Thermal Energy | = | Thermal energy delivered by the system in Btu during the post installation period |
| $\$_{Parasitic\ Loads}$ | = | Cost of operation systems and equipment related to renewable technology |
| $\$_{New\ O\&M\ Costs}$ | = | Addition cost of operations and maintenance due to renewable technology |

Source: FEMP

**Energy Metering**

Determining the electrical output of systems is relatively straightforward. This is because electrical output and parasitic loads can be simply measured with many commercially available meters. Measuring thermal output (e.g., hot water from a domestic hot-water solar system displacing an electric water heating system) is also straightforward, but not necessarily inexpensive, using commercial Btu meters, water flow meters, temperature transducers, etc. However, all of the thermal and electrical output from a system does not necessarily displace an equivalent amount of load. This is due to storage, system losses, and differences in time between when useful energy is produced and when it is needed.

1. ***Electrical Metering***
   Electricity measurements associated with system output, parasitic loads, power to the project site, and power to third parties and the utility may be needed. All electrical meters (and related equipment) are usually provided, installed, owned, and maintained by the ESCO or the servicing utility.

   When a net metering approach is used, meter(s) will typically show the measure's gross output (in kW and kWh) less parasitic use (e.g., pump motors) and sales to third parties or the local utility, as well as any local transformation and transmission and battery storage losses. The goal with this method is usually to measure net generation delivered to the project site. Metering, interconnection (including safety provisions), reporting, and other related issues are to be in accordance with current electrical standards and the requirements of the servicing electric utility.

   With the net energy-use M&V approach, deliveries to and from the facility should be separately recorded and treated as separate transactions. For purposes of power delivered to the site, a single meter that records energy supplied to the site is preferred. If a calculated transformer loss value is used, it should be based on certified factory test data for that particular transformer.

The following are some suggested metering requirements:

- kWh and demand metering at the point of delivery
- Time of-delivery metering
- Provisions for remote meter reading

2. ***Thermal Metering***
   Thermal meters (e.g., Btu meters) are required for measuring the net thermal output of certain renewable energy systems (e.g., hot water generated by an active solar system). Note that metering of thermal energy requires a "net" measurement of flows and enthalpy to and from a system. Measurements of thermal flows may need to take into account any vented or wasted energy that is produced by the system but not used at the site, as well as distribution and storage losses. Also note that small errors in enthalpy measurements (usually determined by temperature) can introduce large errors in the energy calculations; hence, meter precision, accuracy, and calibration are especially important.

**Notes on Some Renewable Energy Technologies**

1. ***Active Solar Thermal Systems***
   Active solar thermal systems include systems for producing industrial process heat, domestic hot water, and space heating and cooling. Useful monitoring includes 1) site inspections and brief temperature and system monitoring for diagnostics, 2) spot, short-term, or long-term monitoring of system key parameters such as temperatures, energy flows, and control status, and 3) utility billing analyses.
2. ***Passive Solar Systems***
   Passive solar systems usually involve the performance of a whole building with architectural features such as overhang design and use of thermal mass. As such, this technology is different from other renewable energy measures, in that, mechanical devices with identifiable energy inputs and outputs are not involved. Thus, passive solar M&V typically involves the analysis of a whole building, and thus it is best to use utility billing analyses or calibrated simulation techniques, i.e., Options C or D.
3. ***Wind, PV, and Other Renewable Generation Projects***
   With these types of systems, the performance characteristics of the components are usually well defined, such as the conversion efficiency of the PV modules or the Btu content of landfill gas. In addition, the electrical or thermal flows can usually be easily measured and Option B is typically utilized. The complexity of these projects lies in projecting long-term performance due to variation in the resources (e.g., solar insolation, wind resource, or reserve of methane gas in a landfill) and accounting for any variations between when the resource is available and when it is needed (i.e., the interaction of storage systems and their inefficiencies).

## IX: ELEMENTS OF THE ENERGY MANAGEMENT SERVICES CONTRACT

The intention of this section is to ***suggest*** elements of the contract to consider, ***not prescribing*** the elements of the contract. Awarding Authority's have the right to include additional terms or refrain from including terms in the contract (except for minimum terms). Parts of DOER's model EMS contract are outlined here along with provisions common to most contracts.

The services provided under an EMS contract incorporate financing (typically a separate agreement with a financier), design, installation, repair, maintenance, management, technical advice, and/or training.

**Definitions**: This section contains definitions relevant to the contract and project. Make sure definitions match those commonly used in engineering.

**Term:** This sets the duration of the contract. In Massachusetts, EMS contracts issued under the enabling law M.G.L. c.25A, § 11C and §11I may have a term of up to twenty years.

**ESCO's Services**: This describes the scope of work that the ESCO performs in the implementation and design of the energy conservation measures. This section outlines responsibilities related to the energy audit, equipment design and construction, maintenance, upgrades or alterations including timelines and standards of service.

**Responsibilities of the Customer**: This outlines the customer's responsibility to conduct certain necessary measures to achieve savings. This ensures that the Awarding Authority understands its commitment and prevents the ESCO from unreasonably claiming that omissions by the customer resulted in unachieved savings.

**Savings:** In an EMS contract, savings measurement is a vital issue. Savings calculation should be stated in energy saved multiplied by the per unit cost of that energy. The total savings cover the total cost of the contract over the contract term. You may use internal funds to finance some ECMs. Make sure to account for the use of these funds in the savings calculations.

**Measurement & Verification Plan**

- Baseline Development Procedure including detailed methodology for calculating savings, the energy baseline, utility rate schedules and floor and ceiling prices for energy and water.
- Monthly Savings Calculation
- Reconciliation of Dollar Estimate of Guaranteed Savings

All savings should be consistent with the savings presented in the IGA. The IGA report should become part of the contract.

**Ownership of Property**: Ownership describes how and when ownership of installed equipment passes to the customer, references a list of equipment warranties, and defines proprietary rights and risk of loss. Equipment ownership may be important to the ESCO for purposes of securing financing or for the tax treatment of the ESCO's revenues under the performance contract. Specific language may include that all equipment installed by the ESCO remains the property of the ESCO during the term and that ownership transfers to the Awarding Authority at the expiration of the performance contract. You may want to consult your attorney should the proposer wish to alter this provision.

In cases where the ESCO's equipment includes software, you should ensure that you receive a license, both during the contract term and perpetually afterwards, to use the software to the extent necessary to operate facility equipment.[27]

**Payment and Guaranty of Savings**: Defines compensation, energy cost savings stated annually, references savings calculations and the method used in those calculations, and any adjustments. Defines the customer's right to retain an independent audit.

**Termination**: Defines the conditions whereby the customer notifies the ESCO of termination, sets a notice schedule, and defines "material breach" and "termination value". Defines actions or conditions that would result in default of the contract by the owner and any that would result in default of the contract by the ESCO. ***Note: Early Termination describes terms and/or conditions for early termination by the owner and the financial considerations of early termination such as penalties, payments, etc.***

**Performance Bonds for Construction**: This section describes in detail the payment and performance bonds provided with the project as they pertain to construction. Performance guarantees such as performance bond, parent or affiliate guarantee, letter of credit or deposit of cash or securities presented to ensure performance, and whether or not restrictions are placed on the guarantees. This section also describes a separate bonding associated with the guaranteed savings.

**Insurance**:

1. Describes provisions for worker's compensation and protective public liability insurance and property damage.
2. Provides for errors and omissions insurance

**Record Keeping**: Outlines requirements for record keeping.

**Force Majeure**: There are events outside the ability of the parties to control, such as any cause beyond the reasonable power of the party claiming Force Majeure. It may include sabotage, strikes, acts of God, war, riot, civil disturbance, drought, earthquake, flood, explosion, fire, lightning, landslide, etc. However, customers should not accept risks properly borne by the ESCO. Economic hardship of either party does not constitute Force Majeure.

**Choice of Law and Forum:** the laws of the Commonwealth of Massachusetts should govern any agreement

**Dispute Resolution**: Describes methods for resolving disputes and a venue for any dispute resolution.

[27] Guide to Energy Performance Contracting, June 1998, South Carolina Energy Office

## X: COMMISSIONING AND MONITORING

Commissioning of installed equipment and systems is considered industry best practice. It ensures that systems are designed, installed, functionally tested in all modes of operation, and are capable of being operated and maintained in conformity with the design intent (i.e., appropriate lighting levels, cooling capacity, comfortable temperatures, etc.). Benefits of commissioning include increased building comfort, reduced operational problems, lower installation costs, fewer contractor callbacks, and improved energy performance. Commissioning new equipment is defined as "the process of ensuring that systems are designed, installed, functionally tested, and capable of being operated and maintained to perform in conformity with the design intent." (ASHRAE, 1996)

Commissioning usually requires taking performance measurements to ensure that systems are working properly. Because of the overlap in commissioning and post-installation measurement and verification (M&V) activities, some people may confuse the two. **The difference is that commissioning ensures that systems are functioning properly; post-installation M&V quantifies how well the systems are working from an energy standpoint.**[28]

Building commissioning is a systematic process of ensuring that a building performs in accordance with the design intent, contract documents, and the owner's operational needs. Due to the sophistication of building designs and the complexity of building systems constructed today, commissioning is necessary, but not automatically included as part of the typical design and construction process. Commissioning is critical for ensuring that the design developed through the whole-building design process is successfully constructed and operated.[29] Please see Reference section on page 40 for a guide to commissioning.

Both the customer's and the ESCO's operation and maintenance responsibilities are defined in the final contract. Both parties have a strong incentive to ensure maintenance is properly performed. Poor operation and maintenance reduces savings, causing standards of service and comfort to deteriorate below the contract requirements. To avoid this situation, integrate project operations and maintenance into overall facility operations and maintenance using appropriate procedures to measure and verify the performance and savings from the project. Summarize and report performance and savings results regularly to key decision-makers. Continue tracking over the long term to identify and correct for any performance deviations.

Because of the design-build nature of EMS projects, the details of the commissioning activities are developed along with the project scope, rather than being explicitly defined at the beginning of the project. For further explanation on commissioning for EMS projects, please refer to the FEMP M&V Guidelines.

[28] FEMP M&V Guidelines
[29] U.S. Department of Energy

## XI: FREQUENTLY ASKED QUESTIONS

### 1) What is Energy Management Services?

Energy Management Services is a type of energy savings performance contracting authorized under M.G.L. c.25A §11C (RFR) or §11I (RFQ). It provides an alternative procurement method to contract for the provision of reducing energy and water consumption.

### 2) What is an Energy Service Company or ESCO?

Energy Service Companies (known as ESCOs) are firms that coordinate all of the activities of a performance contracting project, including: technical audits, design engineering, equipment installation, construction management, project financing, staff training, equipment maintenance and project monitoring. There are many qualified ESCOs pursuing Energy Management Services Contracting projects in New England. Follow the link at mass.gov/doer/Energy Management Services for a complete list of companies certified in Energy Management Services in Massachusetts.

### 3) What payment arrangements are available for Energy Management Services (EMS)?

There are various types of payment arrangements. Third-Party Financing is an alternative method of procuring energy and water conservation equipment at little or no up-front cost. Equipment is generally purchased through the energy and water cost savings generated by the conservation equipment installed. This type of arrangement may require a 10 to 12 year contract (20 years being the maximum allowable term) whereby the ESCO guarantees that the energy savings resulting from the improvements will be greater than the project costs. Municipalities may use a combination of funds including utility rebates, lease arrangements, municipal bonds, capital funds, operating funds, grants, and Renewable Energy Trust Funds.

### 4) EMS contracting allows the same contractor to perform both design and construction. Does that conflict with M.G.L. c. 30B?

No. One may undertake EMS contracting as specified in Massachusetts General Laws Chapter 25A §11C and §11I. This statute allows for the purchase of a "program of services" including, design and construction work that is primarily intended to reduce energy and water consumption.

### 5) Why should I consider EMS contracting instead of a regular construction project?

You would want to consider EMS contracting to reduce your energy bills and obtain new capital equipment with little or no up-front capital investment. Most public agencies consider EMS contracting when they have identified energy conservation potential in their buildings, but do not have sufficient funding to make the improvements.

In addition, EMS contracting offers significant benefits that are not usually associated with standard construction projects, such as, a performance guarantee, expertise that is otherwise not available, or staff training for preventative maintenance. Over the contract term, an ESCO may train facility staff to optimize the performance of installed equipment.

EMS Contracting also allows the contracting entity to minimize risks related to the recouping of costs associated with new efficiency equipment when the ESCO guarantees a specified amount of energy savings because of the installed measures. When guaranteeing a certain level of savings, if those guaranteed savings do not materialize, the ESCO then pays the difference.

**6) What sort of equipment can I fund with an EMS contract?**

Under an EMS contract, Public Agencies may procure any equipment that saves energy or water including, but not limited to the following: energy controls, lighting retrofits, HVAC upgrades, fuel switching, high efficiency motors, and pumps, heat recovery systems, renewables, on sight electricity generation, and cogeneration.

**7) What is the maximum term for an EMS Contract?**

The maximum for either the RFP process (§11C) or the RFQ process (§11I) is twenty years.

**8) We have insufficient funds to support an EMS contract for all of the efficiency improvements that we would like to make. Can we add bond funds?**

Municipalities may provide bond funding. Supplying additional funding may allow you to add improvements with longer paybacks such as windows or insulation, which would not normally be considered by an ESCO.

Although you may "subsidize" an EMS Contracting project, clearly state the value that the funds add to a project. For instance, if you consider a cost-based approach to the final contract, you might identify the specific equipment installed because of your investment in the project.

**9) What can we do if our energy and water bills are high, but we have very limited funds?**

If you are short on funds but your annual energy and water utility bills total over $1,000,000, you may have the potential to develop a successful EMS Contract, depending on the energy efficiency opportunities of your facilities. If your energy and water consumption is too small, consider collaborating with other entities. (Aggregating several projects into one.)

The amount you can save on your utility bills depends on many things: the design of your building, how heavily it is used, whether you are already conserving effectively, alternate fuels available, the amount of capital you can invest, etc.

**10) I need a custodian. Can I get one through EMS contracting?**

No. To hire a custodian or procure services that are primarily maintenance in nature, you must follow specifications outlined in M.G.L. c. 30B.

**11) We are planning major renovations to our buildings in the next few years. Should we still consider EMS Contracting?**

Only if energy and water baselines can be established as reference points for the EMS contract. EMS contracting is a viable financing option if you are planning to improve your energy and water systems, but if renovations increase utility costs, reconsider or delay implementing an EMS contract.

Improvements with little impact on utility costs, such as roofing or disability access, have little effect on energy savings from an EMS contract.

**12) Our town hall needs a lot of work, but it is not big enough for an EMS contract. What can we do to develop a viable project?**

Expand the scope of the project by either including more buildings or evaluating additional conservation improvements. The buildings in a project should cost enough in annual utility bills, including gas, electricity, water, and oil to generate sufficient savings to cover the investment. Often a single building is not big enough to support a successful EMS contracting project. For example, consider expanding the project to include schools, libraries and water treatment plants over which the city or town has jurisdiction, or consider joining with another municipality in a combined bid.

Some of the smaller towns may want to explore advertising their project with others. For successful projects, determine the evaluation criteria, the method of allocating savings, and the contract monitoring before advertising the project. The simplest approach would be to include "common measures" to purchase in bulk by a joint bid.

**13) A contractor claimed that our buildings have great potential for energy and water efficiency improvements. They offered to perform an audit and provided a sample Request for Responses. Should I accept?**

***Do <u>not</u> rely on a contractor to develop your Request for Responses (RFR) or Request for Qualifications (RFQ), either for the document itself or for audit services if the contractor may bid on the RFR.*** Working with an ESCO, either before or during the procurement process may be perceived as giving unfair preference and hindering fair competition. You may face bid protests; legal protests or, at a minimum, forced to re-bid the project.

However, hiring a consultant to conduct an energy audit of the premises and to assist in establishing Measurement and Verification standards and to monitor the actual energy savings achieved may prove to be very helpful, so long as they (and any ESCO's they are associated with) are forbidden from bidding on the project.

**14) Will I get contractors that are more qualified if I require several DCAM certifications?**

In accordance with M.G.L. c.25A §11C §11I and 225 C.M.R. 10.00, Public Agencies must require that firms obtain DCAM certification. However, a company needs only **<u>one</u>** Energy Management Services certification. Requiring additional certifications, such as Electrical or HVAC, will unnecessarily limit competition to those few firms that possess the combination of certifications that you are requesting. Firms that meet the criteria for Energy Management Services are fully capable of performing extensive electrical, heating, and ventilation services.

**15) We would like to expedite this process. How long do I need to advertise?**

The law requires you to allow two (2) weeks between initial advertising and response submission deadline. However, good business practices would indicate that at least six (6) weeks is a more realistic period given the level of complexity of these projects. You will want to ensure that ESCOs responding to your RFR/RFQ have enough time to review the buildings and accurately assess their energy savings potential.

Giving firms at least six (6) weeks to respond to the RFR, also decreases the likelihood of bid protests based on the perception that one firm had prior or preferential access to the site during the brief two-week interval. The six-week timeframe will also give more firms time to learn of the project, thus increasing the competition and quality of responses.

**16) I do not know how to verify the savings. Should I let contractors suggest the best method?**

Do **not** rely on ESCOs who will be bidding on the project to develop the baseline or measurement and verification method. It is the Local Governmental Agency's responsibility to assure that the baseline is accurate. **You will want to base the contract on a baseline that fairly and accurately reflects the facility's energy consumption patterns.** However, you may consider hiring a consultant to assist in establishing Measurement and Verification standards and to monitor the actual energy savings achieved, so long as they (and any ESCO's they are associated with) are forbidden from bidding on the project. Refer to the FEMP M&V Guidelines, V. 3, for accepted methods.

## GLOSSARY

**Baseline:** Current energy utility, water, and fuel costs.

**Baseline Adjustments:** The non-routine adjustments arising during the post-retrofit period that cannot be anticipated and which require custom engineering analysis.

**Baseyear:** A defined period of any length before implementation of the ECM(s).

**Baseyear Conditions:** The set of conditions that gave rise to the energy use/demand of the baseyear.

**Baseyear Energy Data:** The energy consumption or demand during the baseyear.

**Commissioning:** A process for achieving, verifying and documenting the performance of equipment to meet the operational needs of the facility within the capabilities of the design, and to meet the design documentation and the owner's functional criteria, including preparation of operator personnel.

**Degree Day:** A degree-day is measure of the heating or cooling load on a facility created by outdoor temperature. When the mean daily outdoor temperature is one degree below a stated reference temperature such as 18°C, for one day, it is defined that there is one heating degree-day. If this temperature difference prevailed for ten days there would be ten heating degree-days counted for the total period. If the temperature difference were to be 12 degrees for 10 days, 120 heating degree-days would be counted. When the ambient temperature is below the reference temperature, it is defined that heating degree-days are counted. When ambient temperatures are above the reference, cooling degree-days are counted. Any reference temperature may be used for recording degree-days, usually chosen to reflect the temperature at which heating or cooling is no longer needed.

**Energy Audit:** *As defined in the statute*, a determination of the energy consumption characteristics of a building or facility which: (a) identifies the type, size and rate of energy consumption of such building or facility and the major energy using systems of such building or facility; (b) determines appropriate energy conservation maintenance and operating procedures; and (c) indicates the need, if any, for the acquisition and installation of energy conservation measures or alternative energy property.

**Energy Conservation:** *As defined in the statute*, shall include but not be limited to the modification of or change in the operation of real or personal property in a manner likely to improve the efficiency of energy use, and shall include energy conservation measures and any process to audit or identify and specify energy and cost savings.

**Energy Conservation Measure (ECM) —** *As defined in the statute,* measures involving modifications of maintenance and operating procedures of a building or facility and installations therein, which are designed to reduce energy consumption in such building or facility, or the installation or modification of an installation in a building or facility which is primarily intended to reduce energy consumption.

**Energy Conservation Projects:** *As defined in the statute,* projects to promote energy conservation, including but not limited to energy conserving modification to windows and doors; caulking and

weatherstripping; insulation, automatic energy control systems; hot water systems; equipment required to operate variable steam, hydraulic and ventilating systems; plant and distribution system modifications, including replacement of burners, furnaces or boilers; devices for modifying fuel openings; electrical or mechanical furnace ignition systems; utility plant system conversions; replacement or modification of lighting fixtures; energy recovery systems; *on-site electrical generation equipment using new renewable generating sources* as defined in section 11F; and cogeneration systems.

**Energy Management Services (EMS)**: *As defined in the statute*, a program of services, including energy audits, energy conservation measures, energy conservation projects or a combination thereof, and building maintenance and financing services, primarily intended to reduce the cost of energy and water in operating buildings, which may be paid for, in whole or in part, by cost savings attributable to a reduction in energy and water consumption which result from such services. (EMS is a type of energy saving performance contracting.)

**Energy Management System —** A computer programmed to control and/or monitor the operations of energy consuming equipment in a facility. (Not to be confused with the term "Energy Management Services".)

**Energy Savings:** Actual reduction in electricity use (kWh), electric demand (kW), or thermal units (Btu). In dollar amounts, the same multiplied by the unit price. *As defined in the statute*, a measured reduction in fuel, energy, operating or maintenance costs resulting from the implementation of energy conservation measures or projects; provided, however, that any payback analysis to evaluate the energy savings of a geothermal energy system to provide heating, cooling or water heating over its expected lifespan shall include gas and electric consumption savings, maintenance savings and shall use an average escalation rate based on the most recent information for gas and electric rates compiled by the Energy Information Administration of the United States Department of Energy.

**Energy Services Company (ESCO):** A firm which provides a range of energy efficiency and financing services and guarantees that the specified results will be achieved under an energy saving performance contract (as used here, equivalent of an Energy Management Services Contract).

**Measurement & Verification (M&V):** The process of determining savings using one of the four IPMVP Options.

**Metering:** Collection of energy and water consumption data over time at a facility by using measurement devices.

**Monitoring:** The collection of data at a facility over time for the purpose of savings analysis (i.e., energy and water consumption, temperature, humidity, hours of operation, etc.)

**M&V Option:** One of four generic M&V approaches defined herein for energy savings determination.

**Post-Retrofit Period:** Any period of time following commissioning of the ECM.

**Regression Model:** Inverse mathematical model that requires data to extract parameters describing the correlation of independent and dependent variables

**Simulation Model:** An assembly of algorithms that calculates energy use based on engineering equations and user-defined parameters.

**Verification:** The process of examining the report of others to comment on its suitability for the intended purpose.

***Typical Electricity Rate Schedule Terminology***

**Contract Demand:** Power level that the utility guarantees to supply to the building, usually the maximum demand level required for a building to operate.

**Demand Charge:** A charge for the maximum rate at which electricity is used during peak hours of the billing period (Peak Demand), in $/kW-mo. May also have reduced charges for off-peak demand.

**Energy Charge:** A charge for the amount of electricity used in the billing period, in $/kWh-mo. May be separated into peak- and off-peak components of consumption and may vary seasonally.

**Fuel Cost Adjustment, or FCA:** Consumption cost adjustment used to reflect the varying market value of fuel, in $/kWhmo.

**Late Charge:** A fee applied to the entire monthly balance for overdue payment, usually a percentage of the total monthly bill, in dollars.

**Peak Hours:** Daily operating hours during which the highest level of demand for electricity from the utility exists. Electricity costs during these hours may be higher.

**Purchased Power Cost Recovery Factor:** Costs passed on to the customer for power purchased by the utility from other suppliers in $/kWh-mo.

**Sales Tax:** Tariff based on amount of energy consumed in $/kWh-mo.

**Service Charge:** An administrative charge fixed at a small flat rate based on services provided.

***Typical Gas Rate Schedule Terminology***

**Allocation Charge:** Charge for consumption in excess of monthly gas allocation as defined in the service contract, in $/CCF-mo. or $/tTherm-mo. Usually only applied to larger customers.

**Contract Demand:** Maximum daily amount of gas that utility agrees to supply to the building, usually the maximum daily amount of gas that a building requires to operate.

**Demand Charge:** A charge for the maximum daily consumption of gas during the billing period, in $/CCFday or $/thermday.

**Energy Charge:** A charge for the amount of gas consumed during the billing period, in $/CCF-mo or $/therm-mo. This charge may fluctuate seasonally.

**Late Charge:** A fee applied to the entire monthly balance for overdue payment, usually 5% of the total monthly bill, in dollars.

**Pipeline Charge:** Utility costs for rental of pipeline space and recovery fees for financial losses resulting from deregulation, $/CCF-mo or $/therm-mo.

**Purchase Gas Cost Adjustment:** Costs passed on to the customer that reflect the fluctuations in the market value of gas, in $/CCF-mo or $/therm-mo.

**Ratchet Clause:** Penalty for an unusually high monthly demand. The ratchet demand will replace the actual demand levels on bills for 12 months following the peaking incident.

**Sales Tax:** Tariff based on amount of gas consumed, in $/CCF-mo or $/therm-mo.

**Service Charge:** An administration charge fixed at a small flat rate based on services provided, in dollars.

## REFERENCES

### *GUIDES AND DOCUMENTS*

**M&V Guidelines: Measurement and Verification for Federal Energy Projects**, Version 3, April 2008, U.S. Department of Energy

The Federal Energy Management Program (FEMP) M&V Guideline contains specific procedures for applying concepts originating in the International Performance Measurement and Verification Protocol (IPMVP). For a downloadable copy, go to http://www1.eere.energy.gov/femp/pdfs/mv_guidelines.pdf

**A Best Practice Guide to Energy Performance Contracts**, 2000, The Australasian Energy Performance Contracting Association for the Energy Efficiency Best Practice Program in the Australian Department of Industry Science and Resources

For an online copy of this document, go to http://www.aepca.asn.au/documents/epcguide.pdf

**Building Commissioning: The Key to Quality Assurance**, Rebuild America Guide Series, U.S. Department of Energy

Designed to help building owners and retrofit project managers understand and successfully oversee the commissioning process. You can find this and other guides at http://www.peci.org/Library/PECI_BldgCxQA1_0500.pdf

**Financing Energy Efficiency in Buildings**, Rebuild America Guide Series, U.S. Department of Energy

Written for organizations considering investments in energy efficiency projects, this document provides definitions, descriptions, and advice for implementing financial strategies. You can find this and other guides at http://www.mass.gov/Eoeea/docs/doer/rebuild_massachusetts/esmart-financing-energy-efficiency.pdf .

**Green Office Guide**, City of Portland, Office of Sustainable Development. To download, go to http://www.oregon.gov/ENERGY/CONS/BUS/docs/Green_Office_Guide.pdf

**Greening the Building and the Bottom Line**, Rocky Mountain Institute.

For a downloadable copy, go to http://www.rmi.org/images/other/GDS/D94-27_GBBL.pdf

**Guide to Energy Performance Contracting**, March 2006, South Carolina Energy Office

http://www.energy.sc.gov/publications/Revised%20PC%20Manual.pdf

**Guide to Energy Performance Contracting**, July 1998, Hawaii Department of Business, Economic Development, & Tourism, Energy, Resources, & Technical Division. For more information go to http://hawaii.gov/dbedt/info/energy/publications/epc.pdf

**Risk Transfer via Energy Savings Insurance**, October 1, 2001, Evan Mills, Energy Analysis Department, Lawrence Berkeley National Laboratory.

This and other reports on the nexus of insurance and energy management can be found online at http://eetd.lbl.gov/EMills/PUBS/PDF/Energy_Savings_Insurance.pdf

**Risk Management Guide for DOD Acquisition**, Sixth Edition, August 2006, Department of Defense, Defense Acquisition University, Defense Systems Management College. For a downloadable copy, go to http://www.dau.mil/pubs/gdbks/risk_management.asp

## *ORGANIZATIONS AND AGENCIES*

**U.S. Department of Energy**, http://www.energy.gov

**U.S. Environmental Protection Agency**, http://www.epa.gov/

**Energy Services Coalition**

A national nonprofit organization composed of a network of experts from a wide range of organizations working together at the state and local level to increase energy efficiency and building upgrades through energy savings performance contracting. http://www.energyservicescoalition.org

**National Association of Energy Service Companies (NAESCO)**

The primary organization representing the energy performance contracting . http://www.naesco.org/default.htm

**Federal Energy Management Program**, http://www.eere.energy.gov/femp

**Illuminating Engineering Society of North America**, http://www.iesna.org

**Massachusetts Department of Labor and Workforce Development**, Division of Occupational Safety, Preventing Indoor Air Quality Problems during Construction and Renovation http://www.state.ma.us/dos/iaqdocs/IAQ-388.htm

**Washington State University, Total Efficiency Network**

The Total Efficiency Network provides the information, training, and support necessary to save money and resources through efficient resource management at large public and private facilities. http://www.energy.wsu.edu/ten/Default.htm

**PECI, Portland Energy Conservation, Inc.**

The Commissioning & Technical Services Resource Library is a knowledge center filled with technical resources including guidelines, tools, presentations, research papers, and user reviews of our programs and processes. http://www.peci.org/cx_resources.html

**APPENDIX A**
**M.G.L. c.25A §11C and §11I**

**Green Communities Act**
ENERGY MANAGEMENT SERVICES

Definitions

Section 3. For the purposes of this chapter the following words shall have the following meanings:-

"Alternative energy development", shall include but not be limited to solar energy, wood, alcohol, hydroelectric, biomass energy systems, renewable non-depletable and recyclable energy sources.

"Alternative energy property", any property powered in whole or in part by the sun, wind, water, biomass, alcohol, wood, or any renewable, non-depletable or recyclable fuel, and property related to the exploration, development, processing, transportation and distribution of the aforementioned energy resources.

"Building authority", the University of Massachusetts Building Authority , the State College Building Authority or any other building authority which may be established for similar purposes.

"Commissioner", the commissioner of energy resources.

"Department", the department of energy resources.

**"Eligible", able to meet all requirements for offerors or bidders set forth in section 11C or 11I and section 44D of chapter 149 and not barred from bidding under section 44C of said chapter 149 or any other applicable law, and who shall certify that he is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed on the work.**

"End-user", any individual, corporation, firm or subsidiary of any firm that is an ultimate consumer of petroleum products and which, as part of its normal business practices, purchases or obtains petroleum products from a wholesaler or reseller and receives delivery of that product.

**"Energy audit", a determination of the energy consumption characteristics of a building or facility which: (a) identifies the type, size and rate of energy consumption of such building or facility and the major energy using systems of such building or facility; (b) determines appropriate energy conservation maintenance and operating procedures; and (c) indicates the need, if any, for the acquisition and installation of energy conservation measures or alternative energy property.**

**"Energy conservation", shall include but not be limited to the modification of or change in the operation of real or personal property in a manner likely to improve the efficiency of energy use, and shall include energy conservation measures and any process to audit or identify and specify energy and cost savings.**

**"Energy conservation measures", measures involving modifications of maintenance and operating procedures of a building or facility and installations therein, which are designed to reduce energy consumption in such building or facility, or the installation or modification of an installation in a building or facility which is primarily intended to reduce energy consumption.**

**"Energy conservation projects", projects to promote energy conservation, including but not limited to energy conserving modification to windows and doors; caulking and weatherstripping; insulation, automatic energy control systems; hot water systems; equipment required to operate variable steam, hydraulic and ventilating systems; plant and distribution system modifications, including replacement of burners, furnaces or boilers; devices for modifying fuel openings; electrical or mechanical furnace ignition systems; utility plant system conversions; replacement or modification of lighting fixtures; energy recovery systems; *on-site electrical generation equipment using new renewable generating sources* as defined in section 11F; and cogeneration systems.**

**"Energy management services", a program of services, including energy audits, energy conservation measures, energy conservation projects or a combination thereof, and building maintenance and financing services, primarily intended to reduce the cost of energy and water in operating buildings, which may be paid for, in whole or in part, by cost savings attributable to a reduction in energy and water consumption which result from such services.**

**"Energy savings", a measured reduction in fuel, energy, operating or maintenance costs resulting from the implementation of energy conservation measures or projects; provided, however, that any payback analysis to evaluate the energy savings of a geothermal energy system to provide heating, cooling or water heating over its expected lifespan shall include gas and electric consumption savings, maintenance savings and shall use an average escalation rate based on the most recent information for gas and electric rates compiled by the Energy Information Administration of the United States Department of Energy.**

**"Local governmental body", a city, town, district, regional school district or county, or an agency or authority thereof, including a housing authority, board, commission, department or instrumentality of a city, town district, regional school district or county, and any other agency which is not a state agency or building authority; or a combination of 2 or more such cities, towns, districts, regional school districts or counties, or agencies or authorities thereof.**

"Marine or hydrokinetic energy", electrical energy from: (a) waves, tides and currents in oceans, estuaries and tidal areas; (b) free-flowing water in rivers, lakes and streams; (c) free-flowing water in man-made channels; or (d) differentials in ocean temperature, called ocean thermal energy conversion.

**"Minor informalities", minor deviations, insignificant mistakes and matters of form rather than substance of the proposal or contract document which may be waived or corrected without prejudice to other offerors, potential offerors or the public agency.**

"Non-renewable energy supply and resource development", shall include but not be limited to gasoline, natural gas, coal, nuclear energy, offshore and onshore petroleum, and facilities related to the exploration, development, processing, transportation and distribution of such resources and programs established for the allocation of supplies of such resources and the development of supply shortage contingency plans.

"Person", any natural person, business, partnership, corporation, union, committee, club, or other organization, entity or group of individuals.

"Petroleum products", propane, gasoline, unleaded gasoline, kerosene, #2 heating oil, diesel fuel, kerosene base jet fuel, and #4, 5, and 6 residual oil for utility and non-utility uses, and all petroleum derivatives, whether in bond or not, which are commonly burned to produce heat, power, electricity or motion or which are commonly processed to produce synthetic gas for burning.

**"Qualified provider", responsible and eligible person able to meet all requirements set forth in section 11C or 11I, and not barred from bidding under section 44C of chapter 149 or any other applicable law and experienced in the design, implementation and installation of energy savings measures.**

"Reseller", any person, corporation, firm or subsidiary of any firm that carries on the trade or business of purchasing petroleum products and reselling them without substantially changing their form or any wholesaler or retail seller of electricity or natural gas.

**"Responsible", demonstrably possessing the skill, ability and integrity necessary to faithfully perform the work required by a particular contract, based upon a determination of competent workmanship and financial soundness in accordance with section 11C or 11I and section 44D of chapter 149.**

**"Responsive offeror", a person who has submitted a proposal which conforms in all respects to the requests for proposals.**

"State agency", any agency, authority, board, bureau, commission, committee, council, department, division, institution, officer or other agency of the commonwealth, including quasi-public agencies.

"Wholesaler", any person, corporation, firm or any part or subsidiary of any firm which supplies, sells, transfers or otherwise furnishes petroleum products to resellers or end-users.

SECTION 23. Said chapter 25A is hereby further amended striking out section 11C, as so appearing, and inserting in place thereof the following section:-

**Section 11C.** (a) A state agency or building authority may, in the manner provided by this section, contract for the procurement of energy management services. Such contracts may include terms of not more than 20 years. The state agency or building authority shall solicit competitive sealed proposals through a request for proposals. At least 1 week prior to soliciting proposals for a contract under this section, the agency or authority shall notify the commissioner in writing, in such form and including such information as the commissioner shall prescribe by regulation, of the intent to solicit proposals. Such notification shall, at a minimum, include a complete copy of the request for proposals. An acknowledgment of receipt, in such form and including such information as the commissioner shall prescribe by regulation, shall be issued to the state agency or building authority upon successful compliance with the requirements of this paragraph.

Requests for proposals for an energy management services contract to be entered into on behalf of a state agency or a building authority, except a quasi-public agency, shall be developed jointly by the division of capital asset management and maintenance and the using agency. Such proposals shall only be solicited by the division of capital asset management and maintenance after the commissioner of the division has given prior written approval, and no contract for energy management services shall be valid unless approved and signed by that commissioner. A quasi-public agency may develop a request for proposal and enter into a contract for energy management services independently. The commissioner of capital asset management and maintenance may delegate to state agencies and building authorities the authority to enter into such contracts with an estimated construction cost of less than $1 million. The delegation shall be in writing from the commissioner to the using agency or building authority.

The request for proposals published by a state agency or building authority shall include: (1) the time and date for receipt of proposals and the address of the office to which the proposals shall be delivered; (2) a description of the services to be procured, including specific requirements and all evaluation criteria that will be utilized by the state agency or building authority; and (3) proposed contract terms and conditions and an identification of such terms and conditions which shall be deemed mandatory and non-negotiable. The request for proposals may incorporate documents by reference, provided that the request for proposals specifies where prospective offerors may obtain the documents. The state agency or building authority shall make copies of the request for proposals available to all persons on an equal basis. Public notice of the request for proposals shall conform to the procedures set forth in subsection (1) of section 44J of chapter 149. Proposals shall be opened publicly, in the presence of 2 or more witnesses, at the time specified in the request for proposals, and shall be available for public inspection.

Sections 44A, 44B and 44E through 44H, inclusive, of chapter 149 shall not apply to contracts procured under this section. Section 44D of chapter 149 shall apply as appropriate to proposals submitted for contracts under this section, and every such proposal shall be accompanied by: (1) a copy of a certificate of eligibility issued by the commissioner of the division of capital asset management and maintenance; and (2) an update statement. The offeror's qualifications shall be evaluated by the division of capital asset management and maintenance in a manner designated by the commissioner of that division. If the state agency or building authority determines that any offeror is not responsible or eligible, the agency or authority shall reject the offeror, and shall give written notice of such action to the division of capital asset management and maintenance.

State agencies and building authorities shall award contracts under this section to the lowest offeror demonstrably possessing the skill, ability and integrity necessary to perform faithfully energy management services.

Payments under a contract for energy management services may be based in whole or in part on any cost savings attributable to a reduction in energy and water consumption due to the contractor's performance or revenues gained due to the contractor's services which are aimed at energy and water cost savings.

(b) A local governmental body may, in the manner provided in this subsection, contract for the procurement of energy management services. Unless no other manner of description suffices, and the local governmental body so determines in writing, setting forth the basis for the determination, all requirements shall be written in a manner which describes the requirements to be met without having the effect of exclusively requiring a proprietary supply or service, or a procurement from a sole source.

Subject to a local governmental body's authority to reject, in whole or in part, any and all proposals, as provided in this section, a local governmental body shall unconditionally accept a proposal without alteration or correction, except as provided in this paragraph.

An offeror may correct, modify or withdraw a proposal by written notice received in the office designated in the request for proposals prior to the time and date set for opening the proposals. After proposal opening, an offeror may not change any provisions of the proposal in a manner prejudicial to the interests of the local governmental body or fair competition. The local governmental body shall waive minor informalities or allow the offeror to correct them. If a mistake and the intended meaning of the proposal are clearly evident on the face of the proposal document, the local governmental body shall correct the mistake to reflect the intended meaning and so notify the offeror in writing, and the

offeror may not withdraw the proposal. An offeror may withdraw a proposal if a mistake is clearly evident on the face of the proposal but the intended meaning is not similarly evident.

The local governmental body shall evaluate each proposal and award each contract based solely on the criteria set forth in the request for proposals. Such criteria shall include, but not be limited to, all standards by which the local governmental body shall evaluate responsiveness, responsibility, qualifications of the offeror, technical merit and cost to the local governmental body. The request for proposals shall specify the method for comparing proposals to determine the proposal offering the lowest overall cost to the local governmental body, taking into consideration comprehensiveness of services, energy or water cost savings, costs to be paid by the local governmental body, and revenues to be paid to the local governmental body. If the local governmental body awards the contract to an offeror who did not submit the proposal offering the lowest overall cost, the governmental body shall explain the reason for the award in writing.

The evaluations shall specify revisions, if needed, to each proposal which should be obtained by negotiation before the contract shall be awarded to the offeror of the proposal. The local governmental body may condition an award on successful negotiation of the revisions specified in the evaluation and shall explain in writing the reasons for omitting any such revision from a plan incorporated by reference in the contract.

(c) The state agency, building authority or local governmental body may cancel a request for proposals or may reject in whole or in part any and all proposals when the state agency, building authority or local governmental body determines that cancellation or rejection serves the best interests of the state agency, building authority or local governmental body. The state agency, building authority or local governmental body shall state in writing the reason for a cancellation or rejection. The state agency, building authority or local governmental body shall promptly publish in the central register notice of the offeror awarded the contract. The state agency, building authority or local governmental body shall, within 30 days, file a copy of the contract with the commissioner.

The commissioner, in consultation with the commissioner of capital asset management and maintenance, shall adopt regulations for the procurement of energy management services under this section for local government bodies. The commissioner of capital asset management and maintenance shall adopt regulations for services to be procured for state agencies and building authorities, and shall adopt regulations, in consultation with the director of housing and community development, for the operations of housing authorities. Such regulations may limit the scope of services procured and the duration of contracts, and shall include any requirements that the commissioner or the commissioner of capital asset management and maintenance deems necessary to promote prudent management of such contracts at the appropriate facilities. Such regulations shall require the submission, at least annually, of such information as the commissioner or the commissioner of capital asset management and maintenance may deem necessary to monitor the costs and benefits of contracts for energy management services.

(d) The commissioner shall enforce the requirements of this section and regulations adopted hereunder as they relate to local governmental bodies and shall have all the necessary powers to require compliance. The commissioner of capital asset management and maintenance shall enforce all such regulations as they relate to state agencies and building authorities, except quasi-public agencies. An order of the commissioner under this subsection shall be effective and may be enforced according to its terms, and enforcement thereof shall not be suspended or stayed by the entry of an appeal therefrom.

The superior court for Suffolk County shall have jurisdiction over appeals of orders of the commissioner under this subsection, and shall also have jurisdiction upon application of the commissioner to enforce all orders of the commissioner under this subsection. The burden of proof shall be upon the appealing party to show that an order of the commissioner is invalid. An aggrieved person shall not be required to seek an order from the commissioner as a condition precedent to seeking any other remedy.

SECTION 37. Said chapter 25A is hereby amended by striking out section 11I and inserting in place thereof the following section:-

**Section 11I.** (a) A state agency, local governmental body or building authority may use this section in the procurement of energy management services as an alternative to the procedures in section 11C. Nothing in this section shall preclude any such agency, body or authority from proceeding under section 11C.

(b) An agency, local governmental body or building authority may enter into an energy management services contract in order to achieve energy savings at facilities in accordance with this section. All energy savings measures under the contract shall comply with current local, state and federal construction and environmental codes and regulations.

(c) Before entering into an energy management services contract, a state agency, local governmental body or building authority shall issue a request for qualifications. Public notice of the request for qualifications shall conform to the procedures set forth in subsection (1) of section 44J of chapter 149. At least 1 week before soliciting a request for qualifications for an energy management services contract, an agency, body or authority body shall notify the commissioner in writing, in a form and including information as the commissioner of capital asset management and maintenance shall prescribe by regulation, of the entity's intent to solicit qualifications. The notification, at a minimum, shall include a copy of the request for qualifications. An acknowledgment of receipt, in a form and including information as the commissioner of capital asset management and maintenance shall prescribe by regulation, shall be issued by the commissioner to the agency, body or authority upon compliance with the requirements of this subsection.

The request for qualifications published by a state agency, local governmental body or building authority shall include the following: (1) the name and address of the agency, body or authority; (2) The name, address, title and phone number of a contact person; (3) the date, time and place where qualifications shall be received; (4) a description of the services to be procured, including a facility profile with a detailed description of each building involved and accurate energy consumption data for the most recent 2-year period, stated objectives for the program, a list of building improvements to be considered or required and a statement as to whether the proposed improvements will generate sufficient energy savings to fund the full cost of the program; (5) the evaluation criteria for assessing the qualifications; (6) a statement that the agency, body or authority may cancel the request for qualifications, or may reject in whole or in part any and all energy savings measures, when it determines that cancellation or rejection serves the best interests of the public; and (7) any other stipulations and clarifications the agency, body or authority may require, which shall be clearly identified in the request for qualifications.

Qualifications shall be opened publicly, in the presence of 2 or more witnesses, at the time specified in the request for qualifications, and shall be available for public inspection. The provisions of sections 44A, 44B and 44E to 44H, inclusive, of chapter 149 shall not apply to contracts procured under this section. Section 44D of said chapter 149 shall apply as appropriate to qualifications submitted for

contracts under this section, and every such qualification shall be accompanied by (1) a copy of a certificate of eligibility issued by the commissioner of capital asset management and maintenance, and (2) by an update statement.

The state agency, local governmental body or building authority shall evaluate the qualified providers to determine which best meets the needs of the public agency by reviewing the following:
(1) references of other energy savings contracts performed by the qualified providers;
(2) the certificate of eligibility and update statement provided by the qualified providers;
(3) quality of the products proposed;
(4) methodology of determining energy savings;
(5) general reputation and performance capabilities of the qualified providers;
(6) substantial conformity with the specifications and other conditions set forth in the request for qualifications;
(7) time specified in the qualifications for the performance of the contract; and
(8) any other factors the agency, body, or authority considers reasonable and appropriate, which factors shall be made a matter of record.
Respondents shall be evaluated only on the criteria set forth in the request for qualifications.
The state agency, local governmental body or building authority shall conduct discussions with, and may require public presentations by, each person who submitted qualifications in response to the request for qualifications regarding his qualifications, approach to the project and ability to furnish the required services. The agency, body or authority shall select in order of preference 3 such persons, unless fewer persons respond, it considers to be the most highly qualified to perform the required services. The agency, body or authority may request, accept and consider proposals for the compensation to be paid under the contract only during competitive negotiations conducted under subsection (e).
(d) The state agency, local governmental body or building authority may cancel a request for qualifications, or may reject in whole or in part any and all proposals when it determines that cancellation or rejection serves its best interests. The agency, body or authority shall state in writing the reason for a cancellation or rejection.

(e) The state agency, local governmental body or building authority shall negotiate a contract with the most qualified person at compensation which it determines is fair, competitive and reasonable. If the agency, body or authority is unable to negotiate a satisfactory contract with the person considered to be the most qualified at a price the agency, body or authority determines to be fair, competitive and reasonable, negotiations with that person shall be formally terminated. The agency, body or authority shall then undertake negotiations with the second most qualified person. Failing accord with the second most qualified person, the agency, body or authority shall terminate those negotiations and then undertake negotiations with the third most qualified person. Should the agency, body or authority be unable to negotiate a satisfactory contract with any of the selected persons, it may select additional qualified providers who responded to the request for qualifications, in the order of their competence and qualification, and continue negotiations in accordance with this subsection until either an agreement is reached or the agency, body or authority cancels the request for qualifications.

(f) The decision of the state agency, local governmental body or building authority regarding the selection of a qualified provider shall be final and not subject to appeal except on the grounds of fraud or collusion.

(g) The state agency, local governmental body or building authority shall provide public notice of the meeting at which it proposes to award the energy management services contract, of the name of the parties to the proposed contract and of the purpose of the contract. The public notice shall be made at

least 10 days before the meeting. The agency, body or authority shall promptly publish in the central register notice of the award and shall notify the commissioner of the award and provide to him a copy of the energy management services contract.

(h) The energy management services contract shall include a written guarantee of the qualified provider that either the amount of energy savings guaranteed shall be achieved or the qualified provider shall reimburse the state agency, local governmental body or building authority for the shortfall amount. Methods for measurement and verification of energy savings shall conform to the most recent standards established by the Federal Energy Management Program of the United States Department of Energy.

(i) The commissioner, in consultation with the commissioner of capital asset management and maintenance, shall adopt regulations for the procurement of energy management services under this section for local government bodies. The commissioner shall enforce the requirements of this section and regulations adopted as they relate to local governmental bodies and shall have all the necessary powers to require compliance. The commissioner of capital asset management and maintenance shall adopt regulations for services to be procured for state agencies and building authorities. The commissioner of capital asset management and maintenance shall enforce the regulations as they relate to state agencies and building authorities. An order of the commissioner under this subsection shall be effective and may be enforced according to its terms, and enforcement shall not be suspended or stayed by the entry of an appeal. The superior court for Suffolk County shall have jurisdiction over appeals of orders of the commissioner under this subsection, and shall also have jurisdiction upon application of the commissioner to enforce all orders of the commissioner under this subsection. The burden of proof shall be upon the appealing party to show that an order of the commissioner is invalid. An aggrieved person shall not be required to seek and order from the commission as a condition precedent to seeking any other remedy.

(j) Payments under a contract for energy management services may be based in whole or in part on any cost savings attributable to a reduction in energy and water consumption due to the contractor's performance or revenues gained due to the contractor's services which are aimed at energy and water cost savings.

(k) Unless no other manner of description suffices, and the state agency, local governmental body or building authority so determines in writing, setting forth the basis for the determination, all requirements shall be written in a manner which describes the requirements to be met without having the effect of exclusively requiring a proprietary supply or service, or a procurement from a sole source.
(l) Before entering into a energy management services contract, the state agency, local governmental body or building authority shall require the qualified provider to file with the agency, body or authority a payment or a performance bond relating to the installation of energy savings measures in an amount equal to 100 per cent of the estimated contract value from a surety company licensed to do business in the commonwealth and whose name appears on United States Treasury Department Circular 570.

(m) An energy management services contract may extend beyond the fiscal year in which it became effective.

## APPENDIX B: PRELIMINARY SITE ASSESSMENT [30]

**Date _____**
**Facility Name _____**
**Contact Name/ph# _____/_____ Bldg. A _____**
**B _____**
**C _____**

**Potential EEM**

| | BUILDINGS | | | |
|---|---|---|---|---|
| **I. Building Envelope** | **A** | **B** | **C** | **Comments** |
| 1. Install double glazing | | | | |
| 2. Infill glazing | | | | |
| 3. Solar film for glazing | | | | |
| 4. Weather-strip/caulk windows | | | | |
| 5. Install insulated doors | | | | |
| 6. Weather-strip doors | | | | |
| 7. Insulate roof (rigid) | | | | |
| 8. Insulate ceiling (batt/blow) | | | | |
| 9. Insulate wall | | | | |
| 10. Insulate floor | | | | |
| 11. Lower ceiling | | | | |
| 12. Vestibule entry | | | | |
| 13. | | | | |
| **II. HVAC** | | | | |
| A. Boilers | | | | |
| 1. Replace boilers | | | | |
| 2. Upgrade existing boiler | | | | |
| 3. Replace burners | | | | |
| 4. Fuel switch | | | | |
| 5. Reduce steam dist. pressure. | | | | |
| 6. Tune up boiler | | | | |
| 7. Insulate shell and piping | | | | |
| 8. Replace/repair condensate system | | | | |
| 9. Replace/repair steam traps | | | | |
| 10. Install boiler flue damper | | | | |
| 11. Preheat boiler feed water | | | | |
| 12. Preheat combustion air | | | | |
| 13. Time clock w/low temp. override | | | | |
| 14. Zone controller | | | | |
| 15. Boiler reset control | | | | |
| 16. | | | | |

**Note: All energy conservation measures must comply with current local, state, and federal construction and environmental codes and regulations.**

[30] Source: Washington State University, Total Efficiency Network

**Comments:**

| | | | | |
|---|---|---|---|---|
| **B. Furnace/U.V./Roof Top** | | | | |
| 1. Install high eff. Unit | | | | |
| 2. Recondition units | | | | |
| 3. Replace inefficient burners | | | | |
| 4. Install electronic ignition | | | | |
| 5. Install auto flue damper | | | | |
| 6. Fuel switch | | | | |
| 7. | | | | |
| **C. Heat Pumps** | | | | |
| 1. Repair | | | | |
| 2. Install new | | | | |
| 3. Install economizer cycle | | | | |
| 4. | | | | |
| **D. Cooling Systems** | | | | |
| 1. Upgrade inefficient chillers | | | | |
| 2. Install var. speed chiller motor | | | | |
| 3. Add head pressure control | | | | |
| 4. Install strainer cycle to chillers | | | | |
| 5. Utilize evap. cooling | | | | |
| 6. Install cooling tower stage control | | | | |
| 7. Upgrade cooling tower | | | | |
| 8. Install local air conditioners | | | | |
| 9. Install economizer cycles | | | | |
| 10. | | | | |
| **E. Controls** | | | | |
| 1. Install an EMCS | | | | |
| 2. Install optimum start/stop | | | | |
| 3. Install night setback | | | | |
| 4. Install load shedding | | | | |
| 5. Install system optim. cap. | | | | |
| 6. Install warm up cycle | | | | |
| 7. Install deck temp. reset | | | | |
| 8. | | | | |
| **F. Vent/Dist/Term. Equipment** | | | | |
| 1. Convert to VAV | | | | |
| 2. Reduce outside air % | | | | |
| 3. Adjust ventilation rates | | | | |
| 4. Install auto. dampers | | | | |
| 5. Reduce air stratification | | | | |
| 6. Insulate pipes &/or ducts | | | | |
| 7. Modify zoning | | | | |

| | | | | |
|---|---|---|---|---|
| 8. Reduce/elim. heat to h-ways | | | | |
| 9. Reduce/elim. air to unocc. areas | | | | |
| 10. T-stat. rad. control valves | | | | |
| 11. Rebuild/replace steam traps | | | | |
| 12. | | | | |

| | | | | |
|---|---|---|---|---|
| **G. Domestic Hot Water** | | | | |
| 1. Install flow restrictors | | | | |
| 2. Install auto-off faucets | | | | |
| 3. Decentralize hot water heating | | | | |
| 4. Insulate HX piping & tank | | | | |
| 5. Install summer heater | | | | |
| 6. Lower temp. & install boosters | | | | |
| 7. Install instant DHW heaters | | | | |
| 8. DHW pump/tank timers | | | | |
| 9. | | | | |
| **III. Lighting** | | | | |
| 1. Incand. To flour./HID | | | | |
| 2. MV to MH/HPS | | | | |
| 3. Install eff. Ballasts & lamps | | | | |
| 4. Lower fixtures | | | | |
| 5. Delamp & discon. ballasts | | | | |
| 6. Install occup. sensors | | | | |
| 7. Install local switches | | | | |
| 8. Exit light replacement | | | | |
| 9. Install photocell exterior | | | | |
| 10. Timer control exterior | | | | |
| 11. | | | | |
| **IV. Electric Equipment** | | | | |
| 1. De-energize equip. not used | | | | |
| 2. Reduce loads when not req'd | | | | |
| 3. Improve power factor | | | | |
| 4. Convert to eff. motors | | | | |
| 5. Install var. speed motors | | | | |
| 6. Replace oversized motors | | | | |
| 7. | | | | |
| **V. Meters Numbered** | | | | |
| 1. Gas | | | | |
| 2. Electric | | | | |
| **VI. Visual Est. of Potential Savings** | | | | **(1=low, 5=high)** |
| **VII. Training Needs** | | | | |

**Note: All energy conservation measures must comply with current local, state, and federal construction and environmental codes and regulations.**

**Comments:**

**Equipment Replacement**[31]

Replacing HVAC equipment at or near the end of its useful life more efficient equipment. For example, most older boilers seldom operate at their rated output. Replacing old boilers with smaller, high-efficiency, modular (multiple) boilers can boost seasonal efficiencies by 5% to 10% or more.

Replacing existing electric resistance heating systems with heat pumps or other systems that are more efficient or use lower-cost fuel can also provide substantial energy savings.

Replacing existing cooling equipment with higher-efficiency equipment provides attractive paybacks. High-efficiency, direct-expansion cooling units (referred to as packaged or split systems) are twice as efficient as older systems with standard efficiencies.

During replacement or conversion of a chiller, consider upgrades to energy systems that cool or affect cooling load. Installing efficient chiller systems, rather than simply converting them or replacing them with units that meet minimum efficiency criteria, can be an important energy-saving upgrade.

Reducing cooling loads enables you to "downsize" your chiller, saving energy and costing less. You may reduce cooling loads through high-efficiency lighting upgrades or other measures.

The savings associated with purchasing a smaller chiller allows a building owner to buy a more efficient model. Savings from lighting or other upgrades also offset the cost of a more efficient replacement chiller. Another way to reduce new chiller size and cost is to install new, more efficient HVAC auxiliaries (e.g., evaporative cooling towers, coils, variable-speed drives). Alternatively, look for ways to improve the efficiency and operation of auxiliary chiller components and distribution systems.

**Integrating Measures**

Another approach to energy efficiency is considering load-, system-, and plant-level savings opportunities in strict progression. Proponents of this approach cite the multiplier effect that can be achieved if plant-level equipment is significantly downsized as a result of reduced energy requirements at the load and systems levels. For example, the size of plant replacement chillers can be significantly downsized if the building's thermal load and system inefficiencies are reduced. (In large schools, more energy-efficient, computer-driven food preparation equipment lowers the cooling load and simultaneously reduces cooling requirements.) With limited capital, however, this approach will not necessarily achieve the greatest energy and cost savings. Always consider the energy use impacts and interaction of the building, its equipment, and the occupants.

For example, analyze the potential interactions between lighting improvements and mechanical equipment. Lighting improvements generally lower generated heat in the building. As a result, cooling energy will decrease and heating energy will increase. Since overall cost benefits are highly dependent on heating and cooling system efficiencies and fuel costs, dramatic cost benefits might occur in one building, while another building with high heating costs might achieve only half of the predicted savings.

Another example is the interaction between mechanical system upgrades and improvements to the building shell. In some cases, upgrading the heating or cooling system while simultaneously adding

[31] Source: U.S. Department of Energy, Energy Smart Schools Program

insulation can dramatically decrease the savings that might have otherwise been gained from the addition of the insulation alone. In this scenario, either measure alone could be cost-effective, but the second measure would deliver less benefit per dollar of investment. Both examples illustrate the value of examining overall building energy impacts.

## APPENDIX C: FACILITY DATA

Date: _____

Building: _____

Contact Name:

Address: _____

_____

_____

_____

Phone: _____ Fax: _____

Email: _____

1. Number of buildings at the site: _____ Year Built: _____

2. Total Square Footage of Conditioned Area: _____

3. Total annual energy bill: $ _____ Mbtu: _____

a. Electricity: $ _____ kWh: _____

b. Other (Oil, steam, NG): _____ Btus: _____

4. Identification of previous audit(s): Yes _____ No _____

a. Type:

b. Name of Firm: _____

c. Description of changes made to building as result of audit:

_____

_____

5. Is there a site energy management plan? Yes _____ No _____ If yes, attach copy

6. Description of methods used to track energy use and cost.

_____

_____

7. Description of metering set-up and methods used to estimate individual building consumption.

Direct metering _____

Other _____

8. Description of site technical expertise in building systems and energy management (check all that apply).

_____ Building/Facility Manager on site

_____ Energy manager on site

_____ HVAC technician on site

_____ Electrician on site

_____ Engineering expertise on site

No technical staff on site

9. Identify any planned or anticipated mission or usage changes for the near future.

---

10. Person managing utility budget/bill: _____
Phone:

11. Identify any major challenges to the use of EMS Contracting for energy retrofit projects at this facility.

12. Operating Schedules:
Describe the facility's normal operating schedule noting weekday fully and partially: weekend partially and time of year (example, September through June and July and August).

General Information for Each Building
(Relevant Descriptions that could aid in project data development)[32]

- **Building Construction** – Steel, masonry, wood frame, single or double glaze windows, insulated walls and roof, etc.

- **Hot Water and Cooling Systems** – Hot water or steam boiler, forced air furnace, electric resistance, solar etc. Central electric, absorption, or gas driven chillers, window units, rooftop packaged units, etc.

- **Ventilation System** – Ducted single zone, multizone, VAV, dual duct system, through the wall ventilators, no ventilation, etc.

- **Lighting Systems** – Fluorescent T12 or T8, ballast type, incandescent, controls, etc.

- **Renewables** – Solar, wind, geothermal energy in use.

- **Controls** – Ability to shut off equipment or setback temperatures when unoccupied, energy management system, etc.

- **Hazardous Materials Present** – Asbestos, PCB ballast, etc.

- **Upgrades** – What energy system upgrades, equipment changeouts, retrofits or other projects accomplished in building in the last three years?

- **Other Relevant Information Relating to Building or Energy Use** – Historical preservation considerations, etc.

- **Attach a Simple Building or Site Floor Plan.**